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THE BES

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BEST
COMPACT 386SX

This newest addition to our computer line features the Intel 80386 SX 16 MHz microprocessor which uses a 16 bit external bus similar to the 286 AT compatible machines. However internally the 32 Bit 386-SX microprocessor is compatible with that of a 80386 processor. Socketed for optional 80387SX co-processor. Features 1 MB onboard RAM (optionally expandable onboard to 2MB and 4 MB RAM). Processor speed 16 MHz (switchable to 8 MHz), 8 expansion slots, Two serial ports, one parallel port, real time clock, one 1.2 MB floppy disk drive (optionally available with 5.25" 360K or 720K 3.5" floppy disk drive), 101 enhanced keyboard. Features a small footprint, yet it can take as many cards and drives (including hard drives) as full-sized models.

Since this machine has such extraordinary performance at such a low price, we believe it represents the best value in the market today.

BEST
COMPACT 386-16
(16 MHz, 8-slot 386 System)

Based on the Intel 80386 microprocessor, Phoenix BIOS, One 1.2MB Floppy Diskette Drive (Optional 360K 5.25" Floppy Drive or 720K 3.5" Floppy Drive or 1.44MB 3.5" Floppy Drive), socketed for 80387 math co-processor, 8 Expansion Slots, Two Serial Ports, One Parallel Port, Real Time Clock, Floppy Controller and Hard Drive Controller, 101 Enhanced Keyboard. Available with 32-bit memory in the following RAM configuarations: 2 Mb, 4MB, 8 MB, 16 MB. Features a small footprint, yet it can take as many cards and drives (including hard drives) as full-sized models.

Also available
COMPACT 386-20
a 20MHz version
of the above configuration.

BEST
PERFORMER 86 10-3
(10 MHz, 3-slot XT Compatible)

Based on the 16-Bit 10MHz 8086 microprocessor, Phoenix BIOS, Available with one 360K 5.25" Floppy or up to two 720K 3.5" Floppy Diskette Drive, socketed for 8087 math co-processor, 640K RAM, 3 Full-Length XT Expansion Slots, Two Serial Ports, One Parallel Port, Real Time Clock, Also features On-Board Hercules Compatible Display Adapter, Floppy Controller and SCSI Hard Drive controller, key lock for system and case, 101 Enhanced Keyboard.

Optional extras include 20 MB SCSI Hard Drive or 40MB SCSI Hard Drive.

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BEST
PERFORMER 286/12-3
(12 MHz, 3-slots AT Compatible)

Based on the Intel 80286 microprocessor, Phoenix BIOS, One 1.2MB Floppy Diskette Drive (Optionally, use up to two 3.5" 720K or 3.5" 1.44MB Floppy Drives in place of the 1.2 MB Drive), socketed for 80287 math co-processor, 640K RAM (Optionally expandable to 1 MB onboard or higher using 16-Bit memory expansion cards), 3 Full-Length Expansion Slots, Two Serial Ports, One Parallel Port, Real Time Clock, Floppy Controller and a Connors Hard Drive Controller, key lock for system and case, 101 Enhanced Keyboard.

BEST
COMPACT 286-16
(16 MHz, 8-slot AT Compatible)

Based on the Intel 80286 microprocessor, Phoenix BIOS, One 1.2MB Floppy Diskette Drive (Optional 360K 5.25" Floppy Drive or 720K 3.5" Floppy Drive or 1.44MB 3.5" Floppy Drive), socketed for 80287 math co-processor, 640K RAM (Optionally expandable to 1 MB onboard or higher using 16-Bit memory expansion cards), 8 Expansion Slots, Two Serial Ports, One Parallel Port, Real Time Clock, Floppy Controller and Hard Drive Controller, 101 Enhanced Keyboard.

Other BEST Compact 286 Models (which incorporate the above standard features) are:

COMPACT 286-8: Runs at 8MHz
COMPACT 286-10: Runs at 10MHz
COMPACT 286-12: Runs at 12MHz

BEST
AVX 386-20
(20 MHz, 8-slot 386 System)

Super performance in an attractive, practical tower case. Based on the Intel 80386 microprocessor, Phoenix BIOS, One 1.2MB Floppy Diskette Drive (Optional 360K 5.25" Floppy Drive or 720K 3.5" Floppy Drive or 1.44MB 3.5" Floppy Drive), socketed for 80387 math co-processor, 8 Expansion Slots, Two Serial Ports, One Parallel Port, Real Time Clock, Floppy Controller and Hard Drive Controller, 230W Power Supply, 101 Enhanced Keyboard, Available with 32-bit memory in the following RAM configuarations: 2 Mb, 4MB, 8 MB, 16 MB. The tower case has the advantage of plenty of room for practically any combination of floppy and hard drives. Plus a total of 8 expansion cards! Ideal for use as a file server.

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$995

SPECIAL
COMPACT 286-10
$799
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- Significant auxiliary disk storage options are also available through the standard SCSI port
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- Supports multiple operating systems: MS-DOS, OS/2 and/or Unix V.

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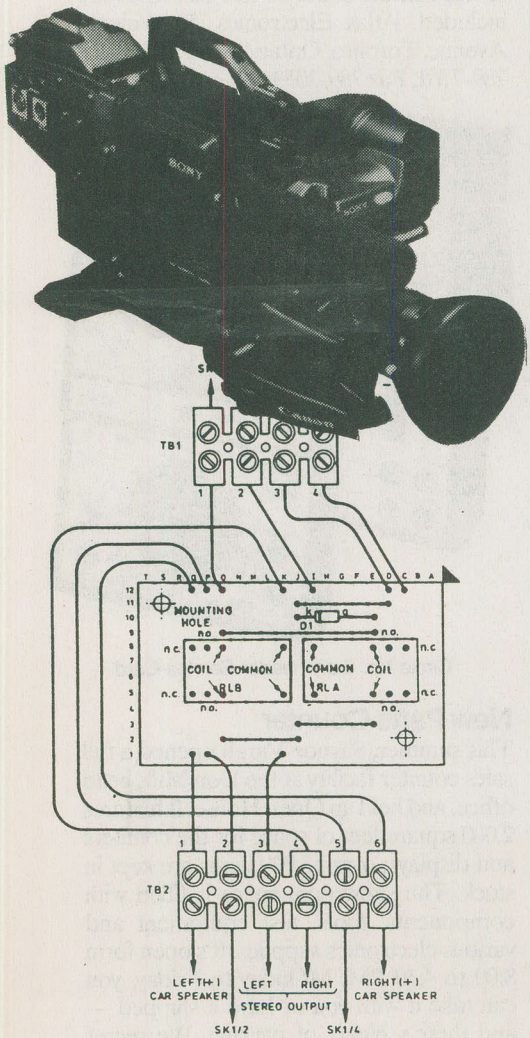
Volume 13, Number 9 September 1989



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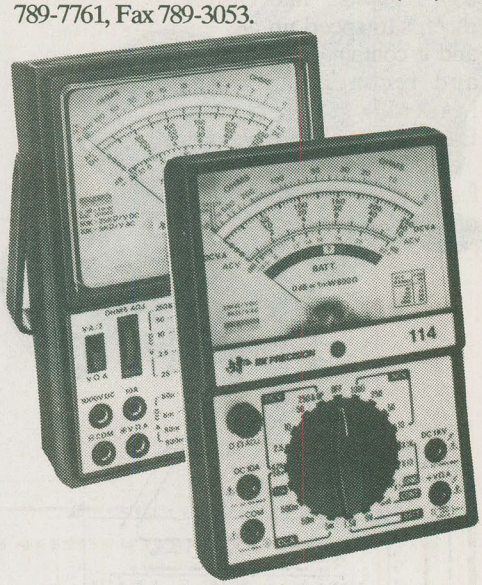
We cannot answer telephone queries. Written queries must be accompanied by a stamped, self-addressed envelope, relate to recent articles and must not involve the staff in any research.

PCB SUPPLIERS
We do not supply printed circuits or kits, and we do not keep track of availability. However, PCBs for projects are available from the following mail order sources:
B-C-D Electronics, PO Box 6326, Stn. F., Hamilton, Ontario L9C 6L9.
K.S.K. Associates, PO Box 266, Milton, Ontario L9T 4N9.
Spectrum Electronics, 14 Knightswood Crescent, Brantford, Ontario N3R 7E6.

New Multimeters

B&K announces the Model 114, a 20,000 ohms/volt multimeter with 24 ranges and a 3.5" mirrored scale, a cost-effective unit that includes batteries and test leads. The Model 214 features 50,000 ohms/volt, 37 ranges and a 4.5" mirrored scale. It also includes diode and fuse protection; a tilt stand, handle, batteries and test leads are included. Atlas Electronics, 50 Wingold Avenue, Toronto, Ontario M6B 1P7, (416) 789-7761, Fax 789-3053.



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New Parts Counter

This summer, Saynor-Varah opened a full sales counter facility at the Don Mills head office, and held an Open House. It features 2,000 square feet of space for the counters and displays; over 53,000 items are kept in stock. The showroom space is filled with components, tools, test equipment and various electronics supplies. It's open form 8:00 to 4:30 PM, MOnday to Friday, you can take it with you or have it shipped – and there's plenty of parking. We regret that the shrimp-and-dip table is not available to the general public – the journalists ate everything. Saynor-Varah Inc., 99 Scarsdale Road, Don Mills, Ontario M3B 2R4, (416) 445-2340, fax 445-0990.

Circle No. 4 on Reader Service Card

Miscellany

The Voltage Controlled Amplifier project from PMI got sidetracked. Perhaps the editor was too busy eating shrimp at press conferences. In any case, we'll have a working demonstrator project for you in the October issue. And it's worth waiting for if you need a professional-quality VCA.

In this issue, you'll find an ad for our Almost Free AutoCAD disk. It's useful to anyone who'd like custom menus and macros to speed up any kind of drawing, and it contains just about every menu tip and technique mentioned in Bill Markwick's ongoing AutoCAD for Electronics series in this magazine.

Incidentally, we wouldn't mind more feedback on the CAD series. Give us a call or letter on any CAD topic – do you use CAD much? Does it do the job?

Call Restrictor

The Telelock TL-16 effectively limits outgoing long-distance telephone calls. Full access can be obtained by entering a code, and the authorized user has a choice of locking out long-distance only and/or all outgoing calls. Optional 976 and 411 call restriction is available. A single unit can control any number of telephones and is easy to install with modular connectors. Macrotronics, 10577-109 St., Edmonton, Alberta T5H 3B1, (403) 428-0916.

Circle No. 5 on Reader Service Card

Continued on page 20

What's New in Video

Continuing last month's look at consumer and professional video equipment.

Edit Controller

Panasonic introduces a new automatic editing controller with full SMPTE time code capability for frame-accurate edits. The AG-A800 Edit Controller can operate up to three VCRs (two source, one edit) in a multi-unit configuration. Its interface arrangement makes it ideal for editing in or between VHSm S-VHS, 3/4" or M-II format machines. The internal memory handles up to 128 edit points; this data can be loaded or saved from a personal computer via an RS232 port. Panasonic Industrial Products Group, Matsushita Electric of Canada Ltd., 5770 Ambler Drive, Mississauga, Ontario L4W 2T3, (416) 624-5010.

Circle No. 8 on Reader Service Card

Industrial VCR

Panasonic Industrial Video has introduced a new industrtial VHS VCR, the model 1240. It features on-screen display for programming ease, auto-repeat playback, and digital tracking to eliminate tracking adjustments when playing tapes made on other machines. The tuner section offers 155 channel capability. Panasonic Industrial Products Group, Matsushita Electric of Canada Ltd., 5770 Ambler Drive, Mississauga, Ontario L4W 2T3, (416) 624-5010.

Circle No. 9 on Reader Service Card

Image Intensifier Camera

Sony's BVP-7000 camera uses a CCD and an image intensifier to produce color images in virtual darkness; its sensitivity is about 10 times higher than most cameras. Designed for low light applications, it also yields impressive results with a horizontal resolution of 370 lines and a signal-to-noise ratio of 59dB. It can perform as a camcorder when used with a Betacam recorder. Sony of Canada Ltd., 411 Gordon Baker Road, Willowdale, Ontario M2H 2S6, (416) 499-1414, fax 497-1774.

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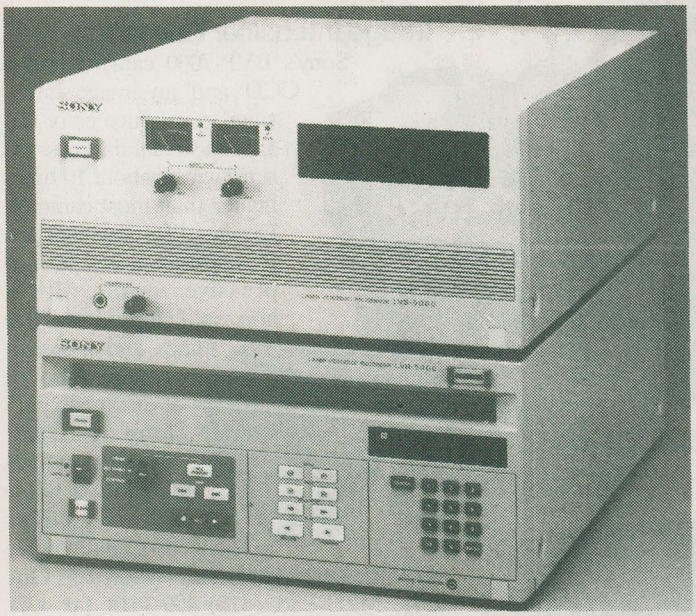
What's New in Video



VideoDisc Processor

The LVR-5000 Laser VideoDisc Recorder and LVS-5000 Processor can record (write-once) video and audio signals on an optical disk with high quality results. The system is equipped with composite and component inputs and outputs. It's capable of external computer control via an RS232 port. Sony of Canada Ltd., 411 Gordon Baker Road, Willowdale, Ontario M2H 2S6, (416) 499-1414, fax 497-1774.

Circle No. 12 on Reader Service Card

Video Colour Printer

Sony's Mavigraph UP-5000 Video Color Printer can reproduce photographic-qaulity prints from NTSC, RGB, ProMavica, Betacam and S-video. The image size is 6" by 4 1/2". Full print operation takes 67 seconds. The unit has broad applications in the broadcast, printing, medical and graphics industries. Sony of Canada Ltd., 411 Gordon Baker Road, Willowdale, Ontario M2H 2S6, (416) 499-1414, fax 497-1774.

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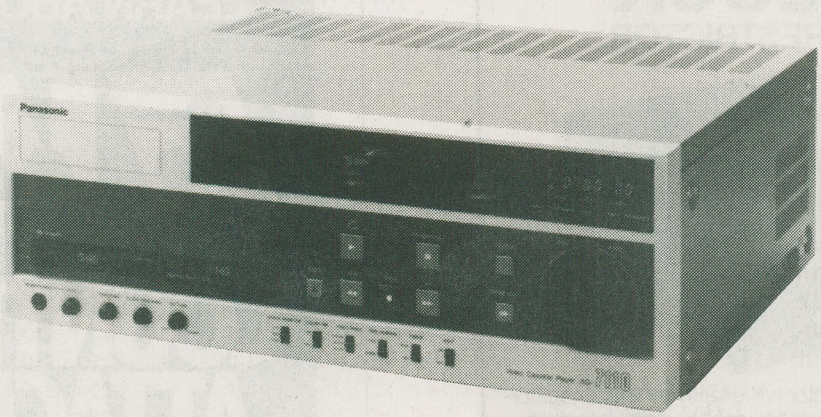


Professional Player

The AG-7110 S-VHS cassette player offers more than 400 lines of resolution, a hifi playback with a dynamicrange of more than 90dB, timecode playback, a 14-step shuttle dial, remote control, and many other features, making it ideal for cable TV, product demonstrations, video libraries, etc. Panasonic Industrial Products Group, Matsushita Electric of Canada Ltd., 5770 Ambler Drive, Mississauga, Ontario L4W 2T3, (416) 624-5010.

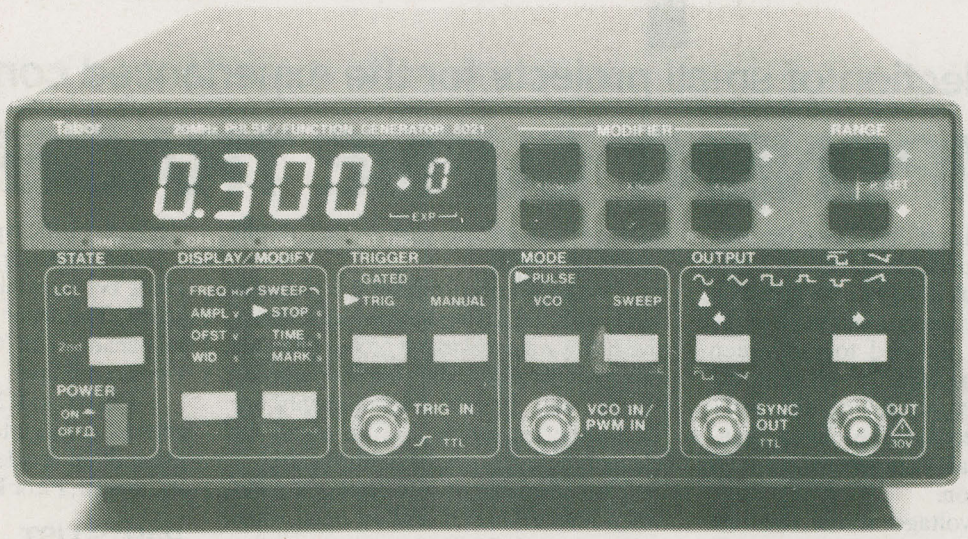
Circle No. 15 on Reader Service Card

Video Editor Player

The AG-7510 S-VHS Edit Source Player provides a digital servo for reduced picture jitter, a capstan override for accurate frame editing with time code, 7-pin dub output, 4-pin S-VHS and 4- channel audio. Jog and shuttle controls are on the front panel. Panasonic Industrial Products Group, Matsushita Electric of Canada Ltd., 5770 Ambler Drive, Mississauga, Ontario L4W 2T3, (416) 624-5010.

Circle No. 14 on Reader Service Card

Tabor 8021 Programmable Function Generator



CPU meets function generator for complete control of input signals.

BILL MARKWICK

The Tabor 8021 Programmable Function Generator is an Israeli-made product, featuring precision control of sine, triangle, square, pulse, TTL pulse and ramp waveforms. Its range is 2mHz to 20MHz (that's *millihertz* at the low end). Repeatable testing is ensured by 30 non-volatile stored setups, with the output selected to be continuous, gated or triggered; a built-in triggering device replaces external units. Frequency control includes linear/logarithmic sweep. And, of course, you can run it all manually.

The sweep generator offers the unusually wide range of 10 decades with eight different sweep modes, both linear and logarithmic. You can set the start and stop frequency and the rate per decade, which is adjustable over the exceptional range of 10mS to 1000 sec/decade. The sweep control voltage (2V/decade) is available as well as a marker (for Z-axis modulation to intensify certain parts of a scope trace).

The output frequency is monitored and controlled by an internal counter; this counter is not available to the user, but results in a frequency accuracy of 0.1% over the range of 10Hz to 20MHz. The output voltage ranges from 20mV to 30Vp-p open circuit, or 10mV to 15Vp-p into 50 ohms. A DC offset signal can be added to the AC output, variable within a window of -15V to +15V open circuit (+/- 7.5V into 50 ohms). Sinewave distortion is less than 0.5% from 20Hz to 100kHz, and less than 1% from 2mHz to 1MHz, with a flatness of 0.5dB up to 2MHz. The pulse output, which can be symmetrical, positive or negative, has a range of 25nS to 9.99 seconds. The ramp, which can be positive-going or negative-going, has a maximum frequency of 150kHz with a width of 5uS to 9.99 seconds.

A four-digit LED display gives a bright readout 14.2mm high; it also has an exponent and polarity indicator. A GPIB interface bus is an option.

The operation of the unit is very straightforward; every pushbutton is sensibly labelled and most functions are self-evident. It takes no time at all to familiarize yourself with the basic operation. And, if all else fails and you find that you've messed up to the point where nothing works the way it should, you can reset all the software to its default states. The quality of manufacture is first-rate, with proper pushbuttons instead of membrane switches (a pox on those!). If you need complete, repeatable control of input signals for testing or R&D, the Tabor 8020 series would be an invaluable addition to the testbench (the 8021 is available without the ramp/pulse function as the 8020; it's also available with an amplitude modulation function as the 8022). At $2840 Canadian, you're buying a remarkable amount of versatility and precision. For further information, contact the distributor, Duncan Instruments, 121 Milvan Drive, Weston, Ontario M9L 1Z8, (416) 742-4448, fax 749-5053. ■

PROJECT

Project Special

A collection of small projects for the experienced constructor.

COMPONENT CURVE TRACER

JOE TRIES

This is a simple circuit that checks the voltage versus current characteristic of a particular component. It works in conjunction with any oscilloscope that can work in the X-Y mode (as opposed to the sweep mode; the vertical amplifier becomes the input and the sweep circuit (or other vertical amplifier) becomes the other). Standard, easy-to-obtain components are used for the construction.

The peak voltage across the test probes is rated at approximately 17VAC. A peak current of 1.7mA will flow through the probes when they are shorted together. These parameters are safe and useful for testing many components.

How It Works

The tracer circuit uses the oscilloscope X-axis to display the voltage (17Vp-p) and the scope Y-axis to display the current (1.7mAp-p). With this in mind, an open circuit on the probe will be displayed as a straight horizontal line. A short circuit will be seen as straight vertical line.

With a 10k resistor connected across the probes, a straight line at 45° will be displayed. Differing resistors can be related to the 10k resistor by observing the angle that they make on the oscilloscope screen.

Reactive components (*ie*, capacitors and chokes) will provide an elliptical trace. Experimentation with good, known component types and values will establish what an acceptable trace is.

Switch S1 can be closed to permit a full-wave signal to be applied to the probes; this means that both a positive- and negative-going voltage will be applied across the tested component. Thus, the forward and reverse current that results can be observed.

With SW1 open, diode D1 is placed in series with the circuit; this provides a positive half-wave signal to the probes (they are polarized by color-coding for this purpose). In this way, polarized components (*eg* electrolytic capacitors) can be tested for charging, leakage or breakdown voltage.

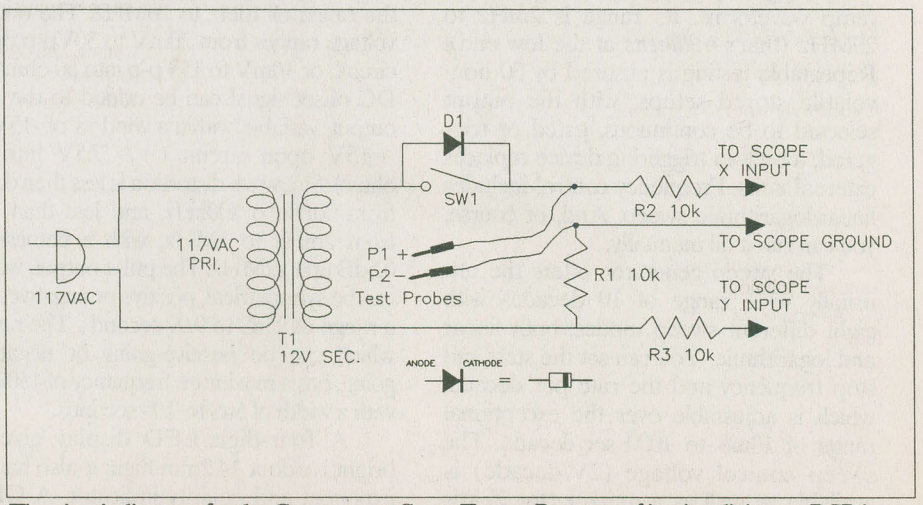
An ideal diode will display a short when forward-biased and an open when reverse-biased. Real diodes can be distinguished as being silicon or germanium by the voltage drop across them during forward-bias (0.7V for silicon and 0.3V for germanium). A zener diode's breakdown voltage can be obtained when the screen is read for the knee voltage (the point where the zener begins to conduct current when forward-biased; the actual voltage depends on the type number).

An appropriate interface must be made between this circuit and the oscilloscope. The scope's input connectors may be banana or BNC; use whatever connectors are required.

Resistors R2 and R3 are used to prevent damage to the transformer in the event of an accidental short between connectors P1, P2 or P3.

PARTS LIST

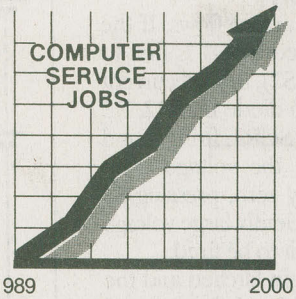
R1-3 10k, .25W, **D1** 1N4001 or 1N4148, **T1** power transformer with 117VAC primary and 12VAC secondary, current rating 50mA or more, with power cord, **SW1** SPST slide or toggle, **P1, P2** red (+) and black (-) test probes, plus suitable connectors for scope inputs, suitable case, perfboard, etc.



The circuit diagram for the Component Curve Tracer. Becuase of its simplicity, no PCB is shown.

5 sure steps to a fast start as a high-paid computer service technician

1. Choose training that's right for today's good jobs



Jobs for computer service technicians will almost double in the next 10 years, according to the latest Department of Labor projections. For you, that means unlimited opportunities for advancement, a new career, or even a computer service business of your own.

But to succeed in computer service today, you need training—complete, practical training that gives you the confidence to service any brand of computer. You need NRI training.

Only NRI—the leader in career-building, at-home electronics training for 75 years—gives you practical knowledge, hands-on skill, and real-world experience with a powerful XT-compatible computer you keep. Only NRI starts you with the basics, then builds your knowledge step by step until you have everything you need for a fast start as a high-paid computer service technician.

2. Go beyond "book learning" to get true hands-on experience

NRI knows you learn better by doing. So NRI training works overtime to give you that invaluable practical experience. You first read about the subject, studying diagrams, schematics, and photos that make the subject even clearer. Then you do. You build, examine, remove, test, repair, replace. You discover for yourself the feel of the real thing, the confidence gained only with experience.

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If you really want to get ahead in computer service, you have to get inside a state-of-the-art computer system. That's why NRI includes the powerful new Packard Bell VX88 computer as the centerpiece of your hands-on training.

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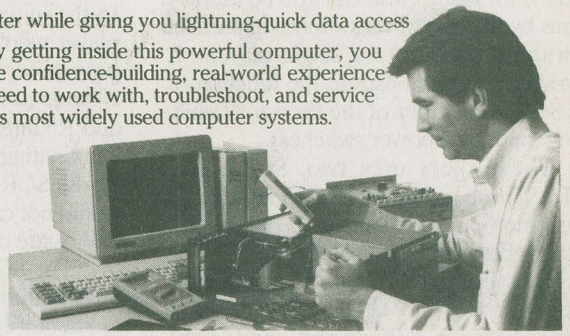

4. Make sure you've always got someone to turn to for help

Throughout your NRI training, you've got the full support of your personal NRI instructor and the entire NRI technical staff. Always ready to answer your questions and help you if you should hit a snag, your instructors will make you feel as if you're in a classroom of one, giving you as much time and personal attention as you need.

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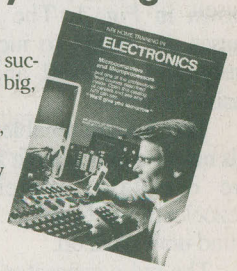

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SNAP INDICATOR

CHRIS BOWES

This simple project will supply a visual indication of who pressed a button first. It's suitable for games, and can also be used by teams by wiring several switches in parallel with those provided for single players. It also serves to demonstrate the function of the SCR, a member of the thyristor family (semiconductor power switches).

The project uses two, SCR1 and SCR2. These are usually found in AC circuits (motor controllers, etc), but in DC circuits they have the useful property that an input pulse to the gate connection causes the SCR to latch and conduct a current between cathode and anode until the DC supply is removed.

This means that we can use the SCR as a memory. When the SCR conducts, the voltage drop across the anode and cathode is virtually zero, so we can design the circuit so that the SCR both switches on an indicator and switches off the trigger voltage, which would be passed to the gate of the other SCR. This gives us a method of detcting who was first to answer.

Circuit Description

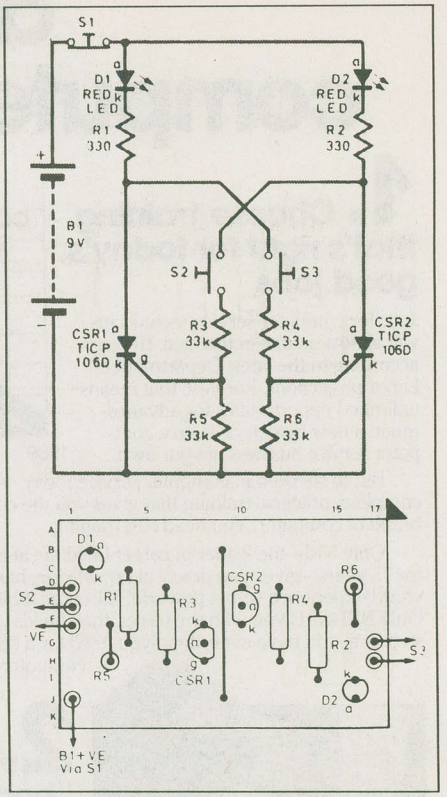
In the initial state no current flows. If the player who's represented by D1 is first to press his or her switch (S2), a small current is made to flow through diode D2, R2, R3 and R5 into the gate of SCR1, firing it and illuminating D1. Since the voltage drop across SCR1 is virtually zero, pressing S3 would not cause a sufficiently large voltage to the gate of SCR2 for it to be fired.

The SCR will remain latched and the SCR lit until the circuit flow is interrupted momentarily. This is done by pressing normally-closed switch S1. The circuit is then reset and ready for another round.

The circuit is constructed on perfboard or stripboard, 11 strips by 17 holes.

PARTS LIST

R1-3: 330, .25W, **R3-6:** 33k, **SCR1-2:** 106D SCR or equiv., **D1-2:** red LED, **S1:** push-to-break pushbutton, **S2-3:** push-to-make pushbutton, **B1:** 9V battery.



PROGRAMMABLE TIMER

CHRIS WALKER

This portable device can accurately time any period from 15 minutes to 3 hours, 45 minutes in 15-minute steps. The circuit can be divided into four discrete parts, as shown in Fig. 1. The pulse generator causes the circuit to increment once for every pulse received, and these form the basis of a timer.

The programmable logic looks for this number and when it appears, activates the oscillator which sounds the piezoelectric transducer. The alarm will sound until silenced.

The pulse generator is formed from a 4541 CMOS IC. Following the oscillator is an on-chip progammble divider which divides the oscillator frequency by either 256, 1024, 8192 or 65536 depending on the binary code at pins 12 and 13; with both at logic 1, the 65536 division is selected and the output is available at pin 8. Pin 6, when taken high, resets the output from pin 8 to zero.

The Counter

Referring to Fig. 2, resistors R1 and R2 and capacitor C1 determine the time constant for IC1's oscillator. Trim pot VR1 is a 22-turn cermet type used to fine-tune the frequency to 1165Hz. Following division by 65536, the output at pin 8 completes one cycle (low to high and back again) in 56.25 seconds.

Every time pin 9 of IC2 goes high, capacitor C3 and resistor R4 generate a pulse to beep the sounder every two minutes to indicate that the timer is working. Constructors who do not want this feature can omit C3, R4 and D2.

Capacitor C2 and R3 produce a pulse at pin 11 of IC2 which ensures that the counter is reset when power is applied. This pulse is also sent to the output via D3 to produce a power-up beep.

The output at pin 3 of IC2 first goes high on the 16th pulse from IC1, or 15 minutes after power-up. Similarly, pin 2 goes high after twice this period (30 min.), pin 4 after one hour and pin 13 after two hours.

PARTS LIST

R1: 33k metal film, 1%, **R2:** 82k, **R3-9:** 100k, **R10:** 39k (all resistors 5%, .25W unless noted). **VR1:** 10k 22-turn cermet trim, **VR2:** 100k carbon trim, **C1:** 10n polyester, **C2-3:** 1u 35V tantalum, **C4:** 10u 16V tantalum, **C5,6:** 10n ceramic, **D1-3:** 1N4148, **IC1:** 4541 CMOS oscillator, **IC2:** 4040 CMOS 12-stage counter, **IC3:** 4012 CMOS NAND, **IC4:** 4093 NAND Schmitt trigger.

S1-4: miniature single-po;le DIP switches (4-way), **S5:** latching pushbutton, **B1:** PX28 6V silver-oxide camera battery, **WD1:** piezoelectric sounder.

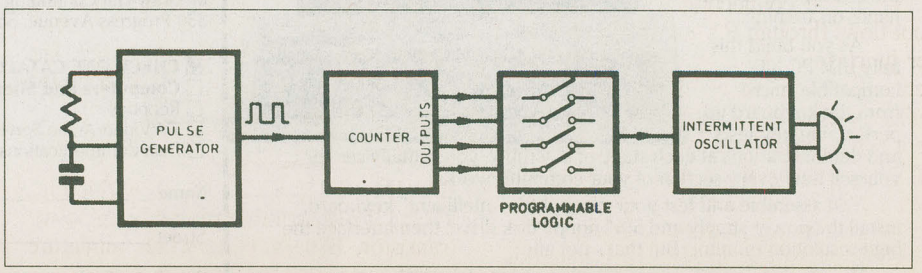


Fig. 1. The system block diagram for the Programmable Timer.

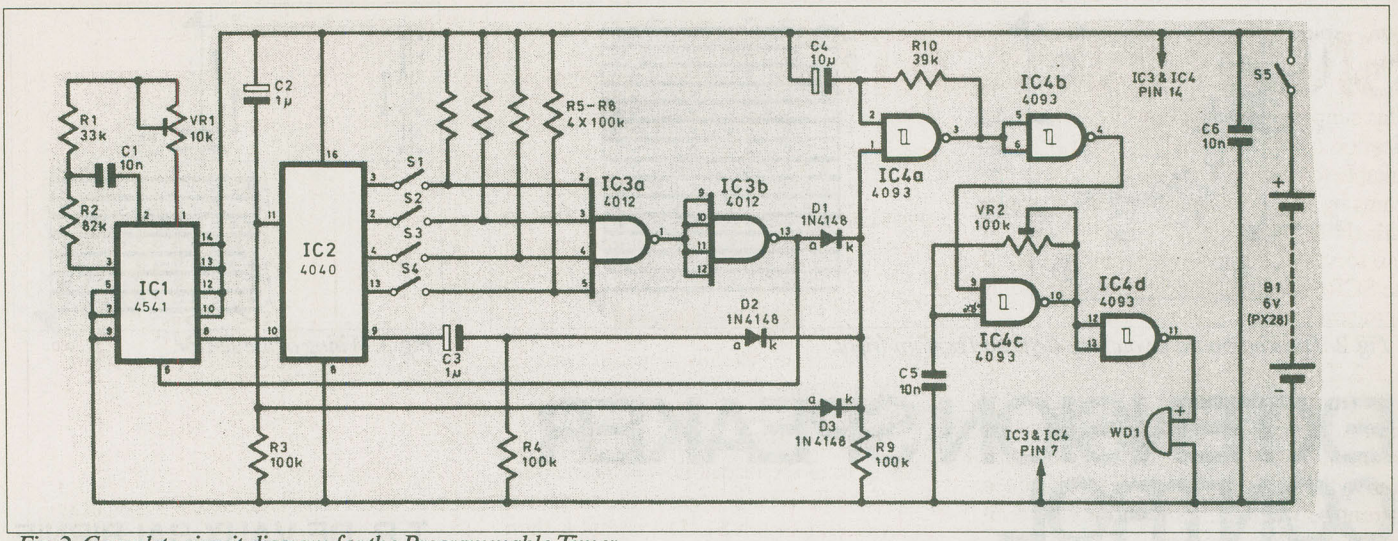


Fig. 2. Complete circuit diagram for the Programmable Timer.

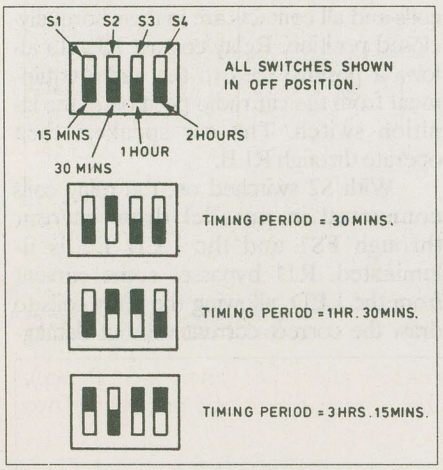


Fig. 3. Various timing combinations.

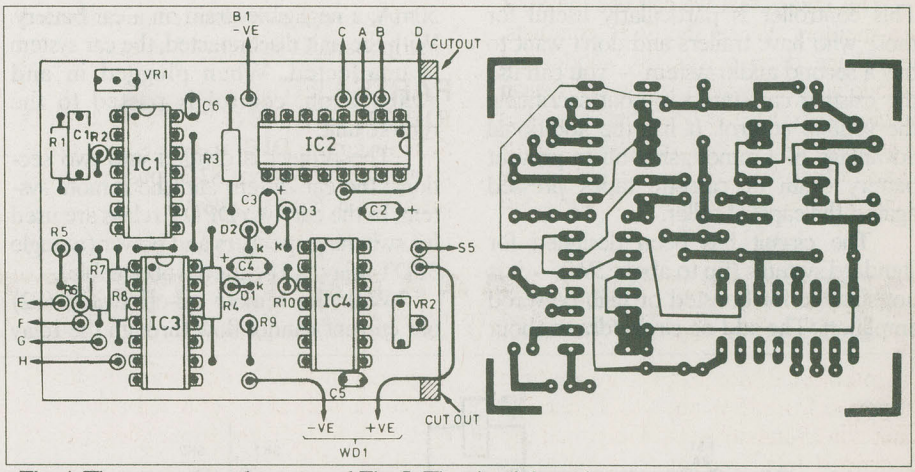


Fig. 4. The component layout. and Fig. 5. The circuit board.

RAIN ALARM

CHRIS BOWES

In this circuit, a Darlington transistor pair amplifies the small current passing through drops of water falling on a sensor and sounds an alarm. The circuit is shown in Fig. 1. Power is supplied by a standard 9V battery.

When a drop of rain bridges the sensor vanes, which are adjacent strips on a piece of stripboard, a small current flows between the connecting wires. This current flows through R1 and the base- emitter junction of TR1. A much bigger current, about 200 times, flows through the collector-emitter circuit of TR1. This current comes from the base-emitter junction of TR2, turning it on and sounding the buzzer. R1 is included to limit the current out of TR1 in case of a short circuit.

When transistors are wired in this manner (Darlington pair), the current gain of the circuit is equal to the gain of the two transistors multiplied together (current gain is the ratio of collector current to base current). In this circuit, current gain is about 4000 times, so only a fraction of the buzzer's small current will flow through the sensor.

The Sensor

All that is required is to wire a piece of stripboard a few tracks deep and a few holes wide (size isn't critical) so that alternate strips may be connected together. The wiring is done with small wire links on the topside of the board.

PARTS LIST

R1: 1M, **TR1:** ZTX300, 2N39094, etc., **TR2:** TIP31A or other plastic NPN power transistor, **B1:** 9V battery, **S1:** miniature toggle switch, **WD1:** 6 to 9V buzzer.

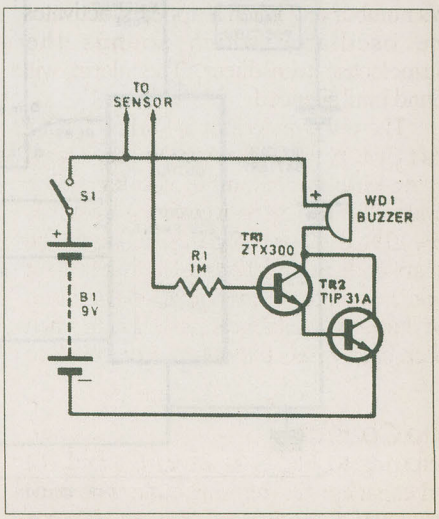


Fig. 1. Circuit diagram of the Rain Alarm.

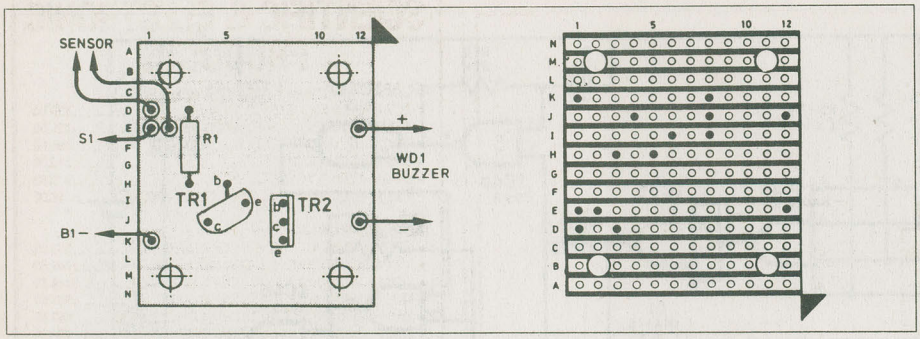


Fig. 2. The Veroboard layout, top (left) and bottom (right.

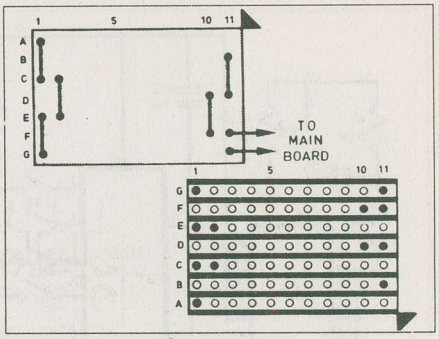


Fig. 3. Wiring of the sensor.

EXTENSION SPEAKER CONTROL

T.R. DE VAUX-BALBIRNIE

This controller is particularly useful for those who have trailers and don't want to buy a second audio system – you can use the existing car stereo without sacrificing the volume control. It has the additional advantage of a remote shut-off to prevent battery drain or cassette tapes pressed against the capstan roller.

The circuit has been designed for standard systems (up to about 5W) – it is not suitable for boosted or high-powered amplifiers. The add-on circuit draws about 50mA, a negligible drain on a car battery. With the unit disconnected, the car system is unaffected. When plugged in and switched on, control is passed to the remote unit.

The project is divided into two sections: the car system and the remote system. In the car, two DPDT relays are used for switching speakers and power (a single 3PDT relay can be used if obtainable).

With the remote on-off switch (S2) off, current cannot flow through the relay coils and all contacts are in their normally-closed position. Relay contact RLA1a allows a positive feed to the audio equipment from the car radio position of the ignition switch. The car speakers then operate through RLB.

With S2 switched on, the relay coils connected in parallel draw current through FS1 and the LED D2 is illuminated. R11 bypasses some current from the LED, allowing the relay coils to draw the correct current without damag-

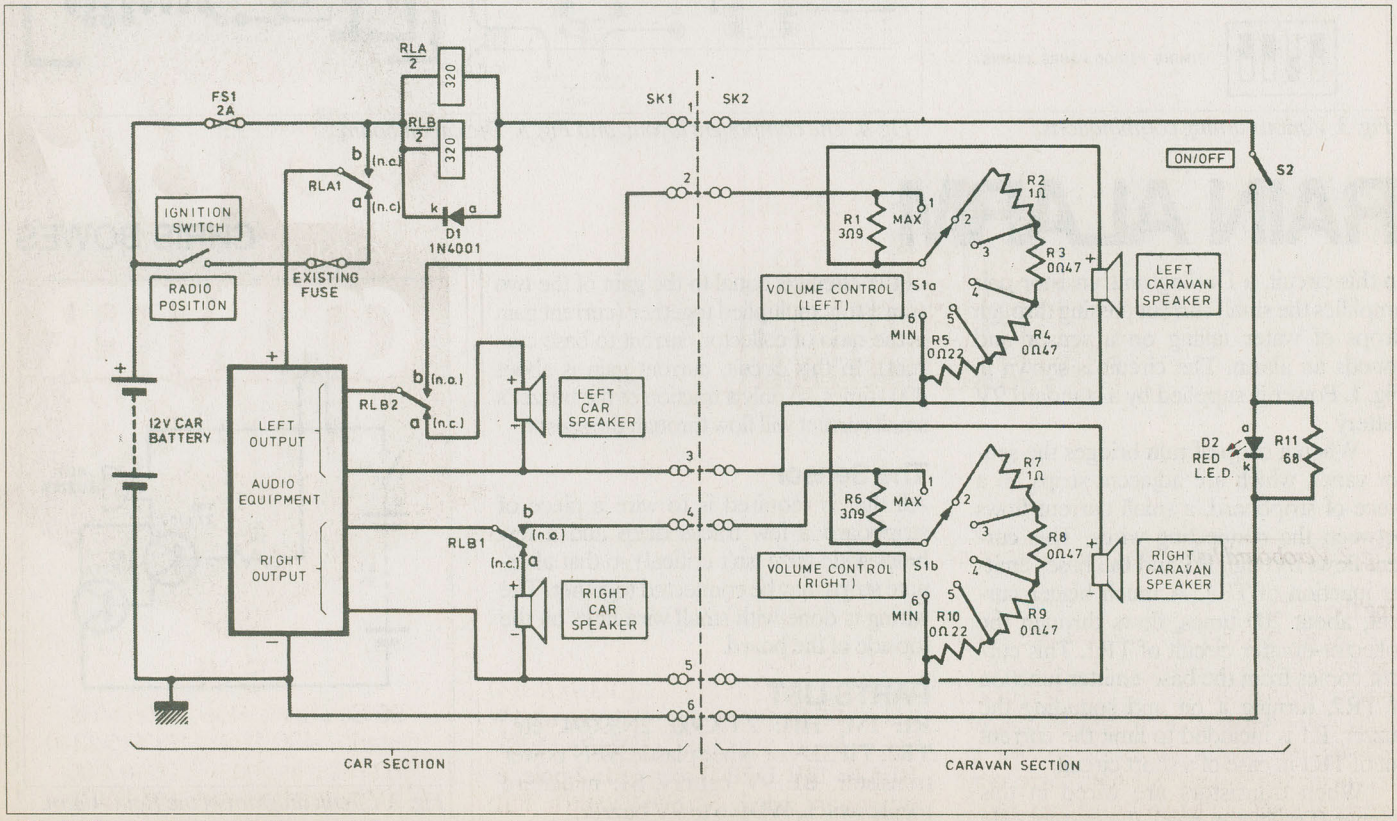


Fig. 1. Circuit diagram of the controller.

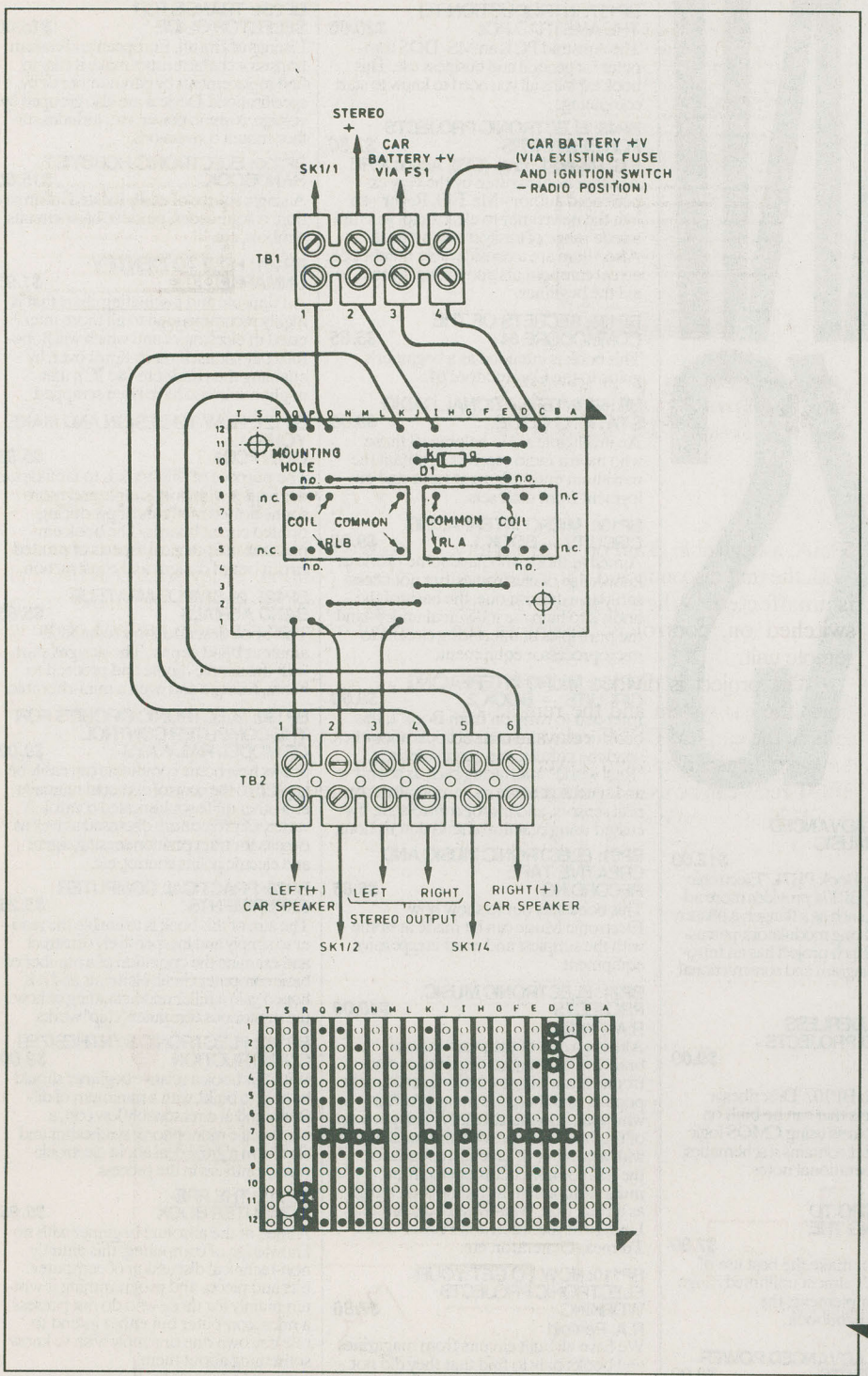


Fig. 2. Veroboard layout (top) and track breaks (bottom)

ing the LED.

In the remote, the speakers are connected to a volume control consisting of a 2-pole six-way switch. The values of resistance chosen provide a good degree of control; although the switch shorts the speaker in the minimum-volume position, there may be some slight audiodue to contact resistance. Note that if R1 or R6 are omitted, the amplifier output could be shorted.

PARTS LIST

R1,6: 3.9 ohms, **:R2,7:** 1 ohm, **R3,4,8,9:** 0.47 ohms, **R5,10:** 0.22 ohms, **R11:** 68; all 1W 5% or larger. **D1:** 1N4001, **D2:** Red LED, **RLA,B:** 12V DPDT relay, **S1:** 2-pole, 6-way rotary switch, **S2: SPST switch, FS1: in-line fuseholder, 2A fuse.** ■

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We have all built circuits from magazines and books only to find that they did not work correctly, or at all, when first switched on. The aim of this book is to help the reader overcome these problems by indicating how and where to start looking for many of the common faults that can occur when building up projects.

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R.A. Penfold

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A "Solderless Breadboard" is simply a special board on which electronic circuits can be built and tested. The components used are just plugged in and unplugged as desired. The 30 projects featured in this book have been specially designed to be built on a "Verobloc" breadboard. Wherever possible the components used are common to several projects, hence with only a modest number of reasonably inexpensive components it is possible to build, in turn, every project shown.

BP122: AUDIO AMPLIFIER CONSTRUCTION *$6.75*

A wide circuits is given, from low noise microphone and tape head preamps to a 100W MOSFET type. There is also the circuit for 12V bridge amp giving 18W. Circuit board or stripboard layout are included. Most of the circuits are well within the capabilities of even those with limited experience.

BP179: ELECTRONIC CIRCUITS FOR THE COMPUTER CONTROL OF ROBOTS *$12.00*

The main stumbling block for most would-be robot builders is the electronics to interface the computer to the motors, and the sensors which provide feedback from the robot to the computer. The purpose of this book is to explain and provide some relatively simple electronic circuits which bridge the gap.

BP108: INTERNATIONALDIODE EQUIVALENTS GUIDE *$7.00*

Cross-references European, American and Japanese diode part numbers. Besides rectifier diodes, it includes Zeners, LEDs, Diacs, Triacs, SCRs, OCIs, photodiodes, and display diodes.

BP118: PRACTICAL ELECTRONIC BUILDING BLOCKS — BOOK 2 *$7.60*
R.A. Penfold

This sequel to BP117 is written to help the reader create and experiment with his own circuits by combining standard type circuit building blocks. Circuits concerned with generating signals were covered in Book 1, this one deals with processing signals. Amplifiers and filters account for most of the book but comparators, Schmitt triggers and other circuits are covered.

For Your Information *Continued from page 7*

Cold Fusion Still Hot

Research into the claimed cold fusion reaction produced quite a series of catcalls and horselaughs last summer, at least according to the popular media, who seemed to be waiting for an overnight miracle. However, the reaction remains intriguing and somewhat mysterious: it produces a heat release by an unknown mechanism without the expected release of neutrons (it was this lack of neutrons that led researchers to say that the process wasn't true fusion).

Work is still going on, and is being monitored by *Princeton Fusion Reports*, 40 North Tulane St., Princeton, NJ 08540, (609) 683-1118. They've published a report, **Cold Fusion: An Objective Assessment,** which is available for $647 US per copy. It features interviews with 150 scientists, economists, business managers, etc. The present state of cold fusion is examined, as well as the question of economic impact should the process work out.

Microscope Breakthrough

The ElectroScan Corporation announced the introduction of the Environmental Scanning Electron Microscope, which allows researchers to view microstructures of unprepared, unfixed biological tissue with the same magnification and resolution as a scanning electron microscope. It is said to bridge the gap between the light and the scanning electron microscope. Until now, biological and wet specimens could not be viewed in their natural state. They can be contacted at 100 Rosewood dr., Danvers, Mass. 01923, (508) 777-9280, fax 777-9288.

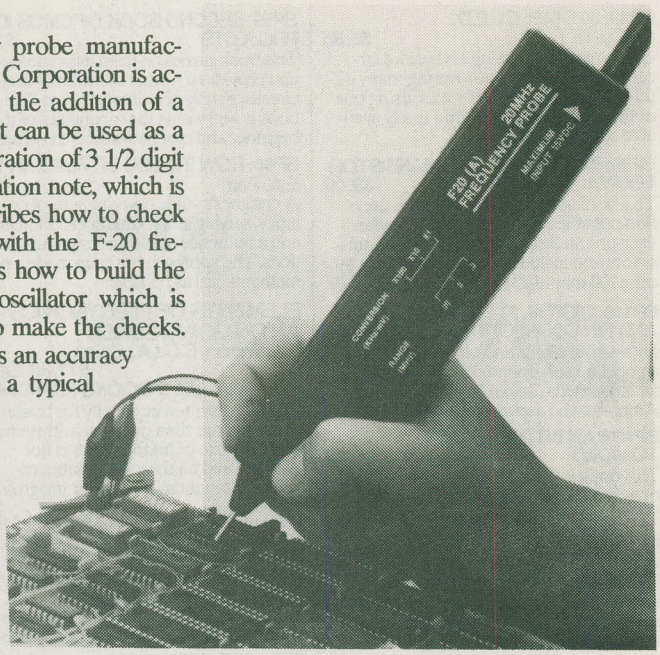
Low-cost Solar Cells

Georgia Tech researchers have reported promising results using a chemical process that may offer greater control for fabricating low-cost solar cell materials. The cost today is roughly $5 per watt; $1 per watt is the target before solar cells can compete economically with other power sources. Chemical vapor deposition is used rather the growth of single-crystal silicon, with one solar cell on top of another made from complementary materials to absorb a much larger percentage of the solar spectrum and improve efficiency. An efficiency of 25% should be possible. Research is also going on to investigate the use of polycrystalline materials that may be cheaper than silicon.

Application Note

The 20MHz frequency probe manufactured by I.M. Instrument Corporation is accurate enough that with the addition of a simple crystal oscillator it can be used as a quick check on the calibration of 3 1/2 digit multimeters. The application note, which is being offered free, describes how to check multimeter calibration with the F-20 frequency probe, as well as how to build the simple fixed-frequency oscillator which is paired with the probe to make the checks. The frequency probe has an accuracy of 0.005% at 25°C and a typical long-term stability of 0.01% per year. Contact I.M. Instrument Corporation, PO Box 2215, Brantford, Ontario N3T 5Y6, (519) 756-3770.

Circle No. 22 on Reader Service Card



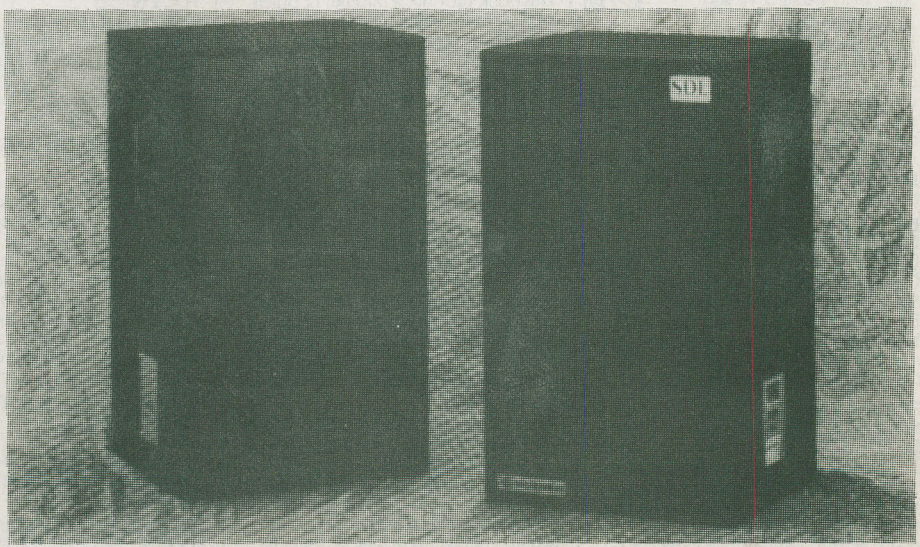
Need Speed?

Precision Monolithics has introduced the OP-61, an op amp with a bandwidth of 200MHz at 1Mhz. The gain-bandwidth is 70% greater than previously available amps of a similar type. In addition to wide bandwidth and low noise, the OP-61 has high open-loop gain (400V/mV) and low offset voltage (200uV typ.). At PMI dealers, or contact them at 1500 Space Park Drive, Santa Clara, CA 95052- 8020, (408) 727-9222, fax 727-1550.

Canadian Computer Show

The 20th annual Canadian Computer Show will be held October 23 through 26 at the International Centre, 6900 Airport Road, Mississauga, Ontario, 10:00AM to 6:00PM. The sponsor is the Canadian Information Processing Society. Registration is $15 at the door; parking is free.

Servodrive Woofers



Would you like a bass response of 114dB at 16Hz? The Servodrive Contra Bass from Intersonics can provide it for you without voice coils. The unique servo system allows enormous power inputs and very high efficiency at low frequencies. The speakers are used in clubs, touring (by Michael Jackson), special effects (Disney World), etc. Contact Equity Sound Investments, 629 Eastern Avenue, Unit 2, Toronto, Ontario M4M 1E4, (416) 465-4888.

Continued on page 29

MOORSHEAD PUBLICATIONS

SOFTWARE CATALOGUE FALL 1989

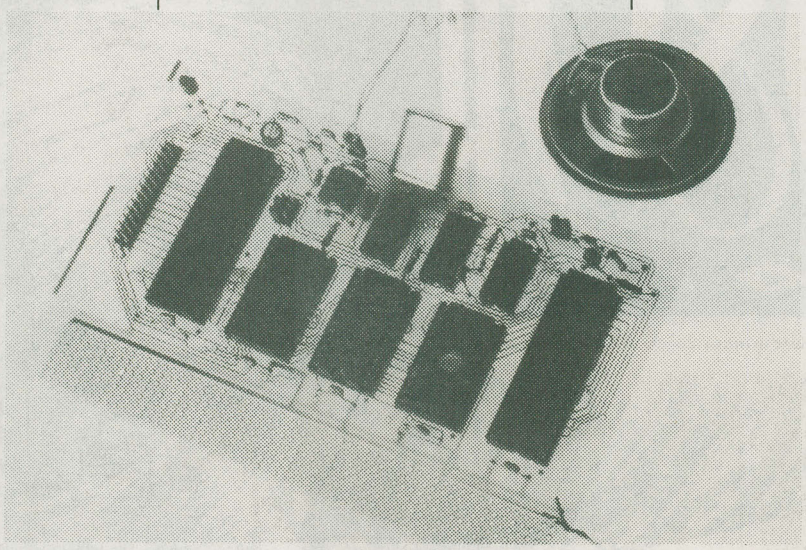
MOORSHEAD PUBLICATIONS

SLOTH

THE COMPUTER THAT CAN'T DO ANYTHING

Computers can do a lot more than just manage data bases and play video games. Specialized microprocessor boards can be used as programmable frequency counters, intelligent temperature controllers, timers, monitors... dedicated microcomputers are at the heart of most of the sophisticated high tech toys that make our lives exciting and our bank balances so easily managed with just a few fingers.

Unfortunately, most individual humans donn't get to work with small, board level micros. These things usually have to be custom designed, which is generally beyond the abilities and the means of most of us. This is unfortunate, as working with compurter hardware at this level is fascinating... and can give one the power to create unspeakably sophisticated projects.



This is why we created the SLOTH. The SLOTH is a small Z80 based computer which is designed to be turned into things. It has no screen, keyboard, floppy disks or printer port... but it's easy to get parts for, quick to assemble and painless to program. It has powerful I/O facilities to allow you to interface it to anything you want to make it work with, from the remote control of a video recorder to the ignition of your car.

The SLOTH isn't a trainer... it's designed to be built up into working projects. It's programmed with inexpensive 2716 EPROMs. It has twenty-four lines of I/O and three programmable counter timers to talk to the rest of the world with. Included on the main SLOTH board are a speaker driver, two kilobytes of static RAM, a pulse source and jumpers to allow you to configure the system to do what you want it to do.

The basic SLOTH also comes with a peripheral board to let one's program control a six digit LED display.

If you have a rudimentary knowledge of assembly language programming, a working soldering iron and a burning desire to get into the fast lane of computer technology, you should try the SLOTH. The October 1986 edition of Computing Now! features an extensive look at the construction of the SLOTH board and a sample program for it. Other issues carry some basic SLOTH applications... timers, controllers and other things that can be made with the SLOTH. However, the low cost and flexibility of the SLOTH will unquestionably give you countless ideas for projects of your own.

The SLOTH package available from us includes a bare SLOTH board... both the main processor board and the LED display board... a parts list, a complete schematic and parts overlay, a source listing for an exercise program and a set of article reprints to explain the system in painstaking detail. In addition to this you'll need the parts to stuff the board... which are widely available... and a computer capable of running an 8080 or Z80 assembler and burning the resultant code into 2716 EPROMs. We recommend an Apple compatible system running CP/M with a Multiflex PROM burner or a PC running Z80MU and a PC compatible EPROM programmer. Z80MU, a CP/M emulator for the PC, is available separately from our service for $19.95.

The SLOTH can be whatever you want it to be... it's the most interesting electronics project on the planet. The complete SLOTH package is available for only $37.95.

ORDER THE SLOTH FOR $37.95 (PLUS 8% O.S.T. & $1.50 SHIPPING FROM MOORSHEAD PUBLICATIONS
1300 DON MILLS ROAD, NORTH YORK, ONTARIO M3B 3M8 PHONE: (416)445-5600 FAX: 416-445-8149

MOORSHEAD PUBLICATIONS

ELECTRONICS & TECHNOLOGY SOFTWARE SERIES

VOLUME ONE

This is the first in a series of software collections assembled specifically for people working with electronics and related fields. In it, we have tried to include programs for a variety of interests. The Perfect speaker enclosure design program will appeal to audio enthusiasts... it gives you access to the same sort of calculation facilities that profession speaker engineers use. There are several programs which will be of help to amateur radio operators. Finally, things like BDS will find use in just about any electronic application.

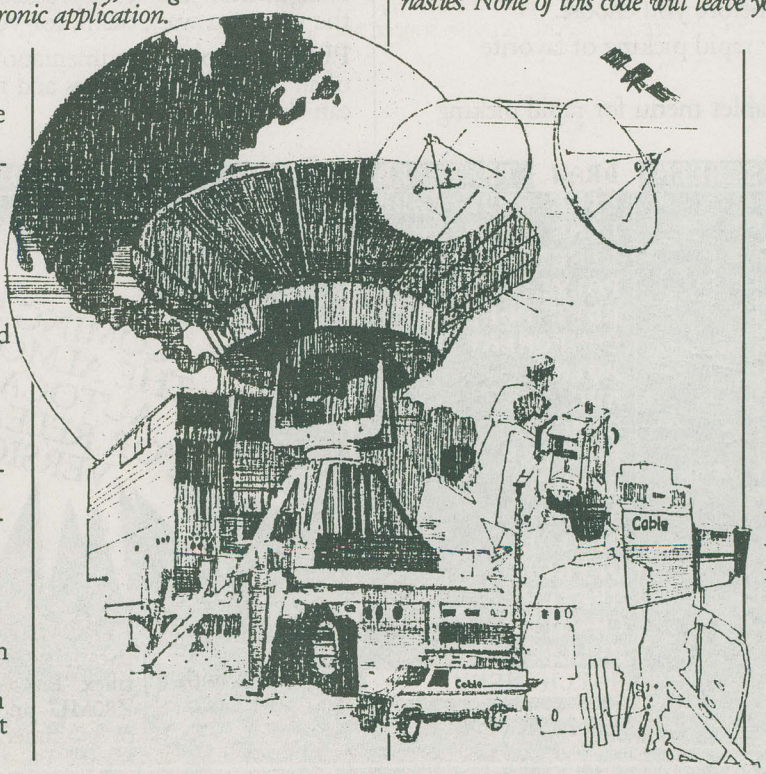
As with all our Almost Free Software collections, this one carries our promise of satisfaction. If, after checking it out, you aren't completely happy with it, we'll buy it back from you with no questions or hassles.

In addition, unlike as with other sources of public domain code, we've scrutinized all of these programs carefully for viruses and other nasties. None of this code will leave your hard drive a smoking ruin.

PERFECT is a powerful system to design speaker enclosures. It allows for a wide variety of general box designs and speaker sizes and impedances. All you do is to plug in the appropriate numbers and it will spit out both the dimensions of the box and tell you how it will perform. Saves hours of work and calculations and a lot of wasted wood.

BDS is a pop up utility especially designed for electronics. It performs a number of common calculations, including inductance, capacitance, wavelength and so on. It's better than having a paid lacky with a calculator because you don't have to feed pop up utilities.

DIPOLE is a simple program to handle the calculations for dipole antennas. It's written in BASIC so you can even take it apart and see what it's up to.



GEOS is a great program for finding the location of geo- stationary satellites. It provides everything you need to align a satellite antenna from anywhere in Canada... all without recourse to charts, books, prayer or higher mathematics.

PARABOLA is a BASIC program to help design parabolic antennas. It lets you calculate all the grotty details for anything from a Ku band dinner plate to your own DEW line backscatter radar system.

VSWRCALC calculates voltage standing wave ratios for any wavelength.

YAGI-UDA is a really complex program for an even more complex problem... designing Yagi antennas. Plug in some numbers and it will spit out a sky hook.

THIS DISK IS ONLY $19.95 (PLUS 8% O.S.T. & $1.50 SHIPPING) FROM MOORSHEAD PUBLICATIONS
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ALMOST FREE SOFTWARE

AUTOCAD

VOLUME ONE — RELEASE 9 VERSION

SPEED UP DRAWING AND EDITING IN RELEASE 9 — MINIMIZE TYPING AND CORRECTING!

INCLUDES:

A **custom pull-down menu** with over 150 of the most-often used commands, values and related variables grouped in logical order — almost eliminates searches and menutrees. Includes custom macros that call up a series of commands with a single pick.

Custom icon menus let you see your symbol library drawings or hatch patterns before you choose.

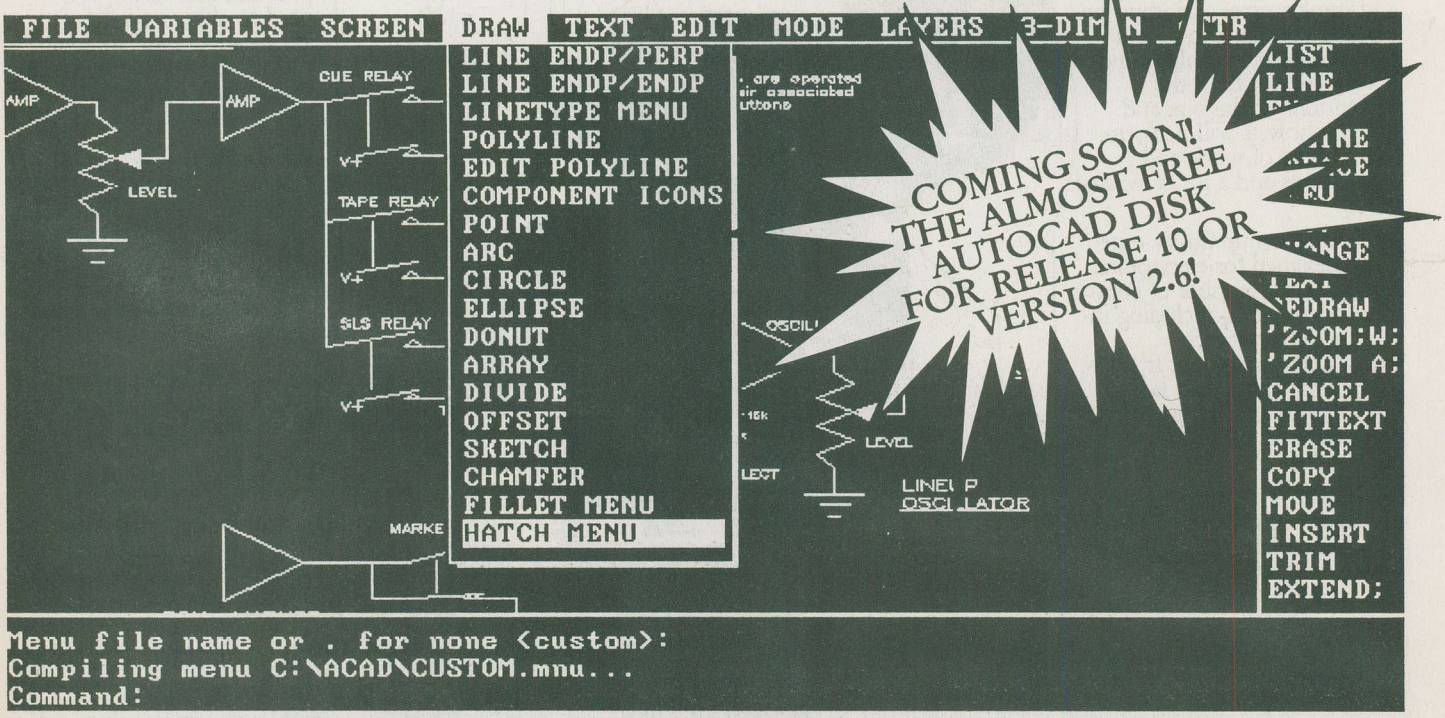
A **custom screen menu** for rapid picking of favorite commands or macros.

A **custom 175-command tablet menu** for rapid picking of commands and macros (requires digitizing tablet), plus a blank DWG and menu file for making your own.

A **library of common analog and digital electronic schematic symbols**, complete with **icon menus** for no-typing selection.

PLUS: *All the menus are ASCII files and can be easily changed with your word processor.* Edit the commands just the way you want them, for your style of drawing.

PLUS: complete documentation files with explanations of all the menu structures and macros and how you can change them.



COMING SOON! THE ALMOST FREE AUTOCAD DISK FOR RELEASE 10 OR VERSION 2.6!

What you need: A copy of AutoCAD Release 9 (the menus work with Release 10, but do not include Release 10 commands — versions prior to Release 9 do not support pulldown menus), a mouse or digitizer tablet (a digitizer is required for the tablet menus) and any version of DOS.

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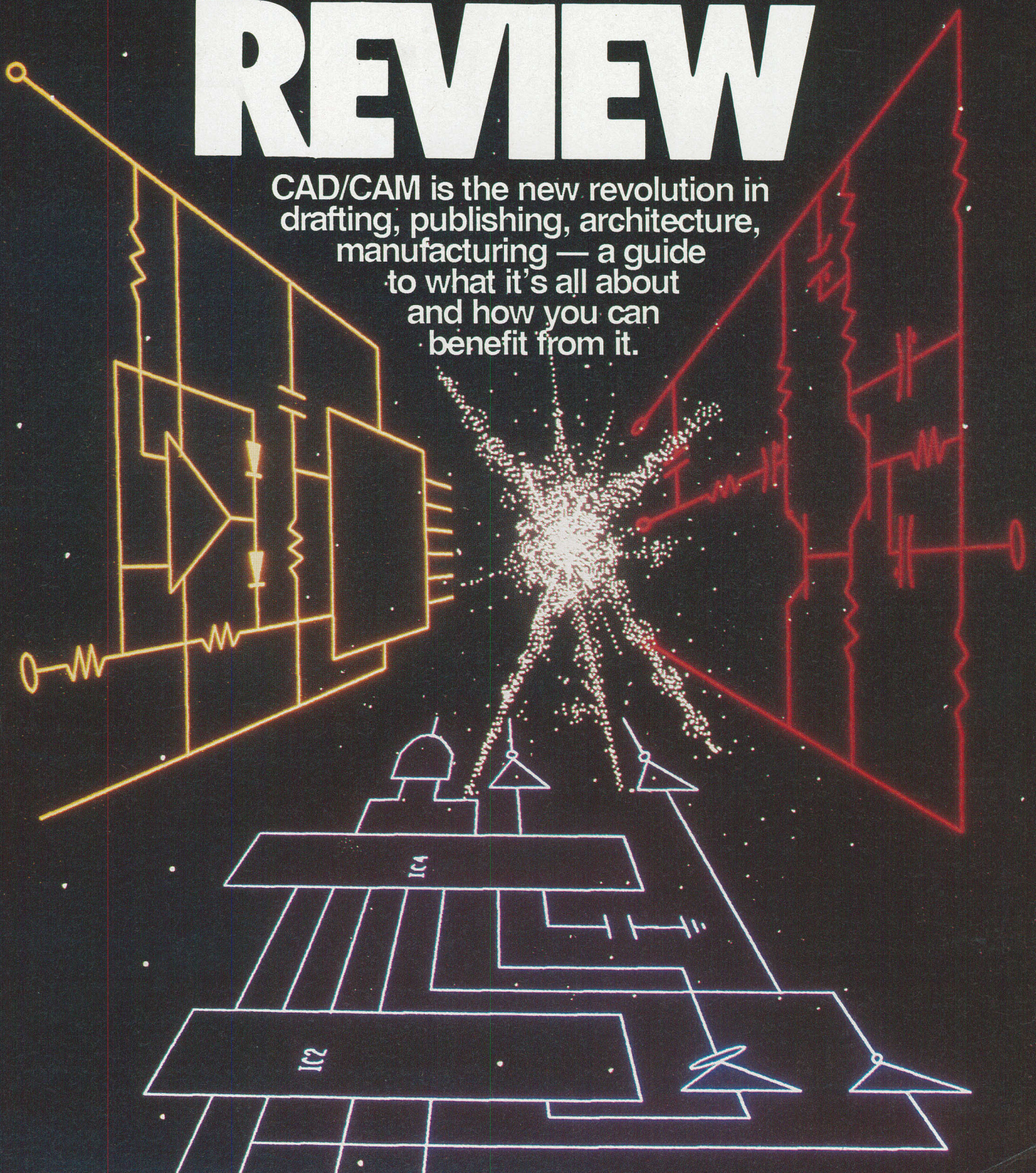
CAD/CAM REVIEW

CAD/CAM is the new revolution in drafting, publishing, architecture, manufacturing — a guide to what it's all about and how you can benefit from it.



A SPECIAL SUPPLEMENT TO GOVERNMENT PURCHASING GUIDE, BUSINESS COMPUTER NEWS, COMPUTING NOW!, ELECTRONICS & TECHNOLOGY TODAY AND COMPUTERS IN EDUCATION

Some great minds contemplate the stars.

We create them.

Meet the Toshiba T8500. In every way, as a LAN server, Unix platform, or both, it's a stellar achievement that provides outstanding performance. It has the ability to become the centre of your expanding office computing universe.

It can add new dimensions of power, flexibility, speed and storage without having to change your system. It will become the hub around which other desktops and portables in your world revolve. Not only that, but it's striking to look at and very compact.

The T8500 also has several other bright points to separate it in a galaxy of others.

- 64KB cache memory integrated with 80386 processor (25MHZ)
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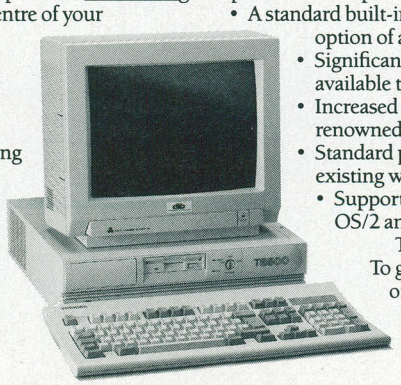
- A standard built-in, fast, 100 MB hard disk drive, with the option of a second one or a 150MB tape back-up unit
- Significant auxiliary disk storage options are also available through the standard SCSI port
- Increased raw memory capacity with Toshiba's world renowned DRAM chip technology (2MB standard)
- Standard protocols which allow interface with existing well-known LAN software
- Supports multiple operating systems: MS-DOS, OS/2 and/or Unix V.



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INFORMATION SYSTEMS DIVISION

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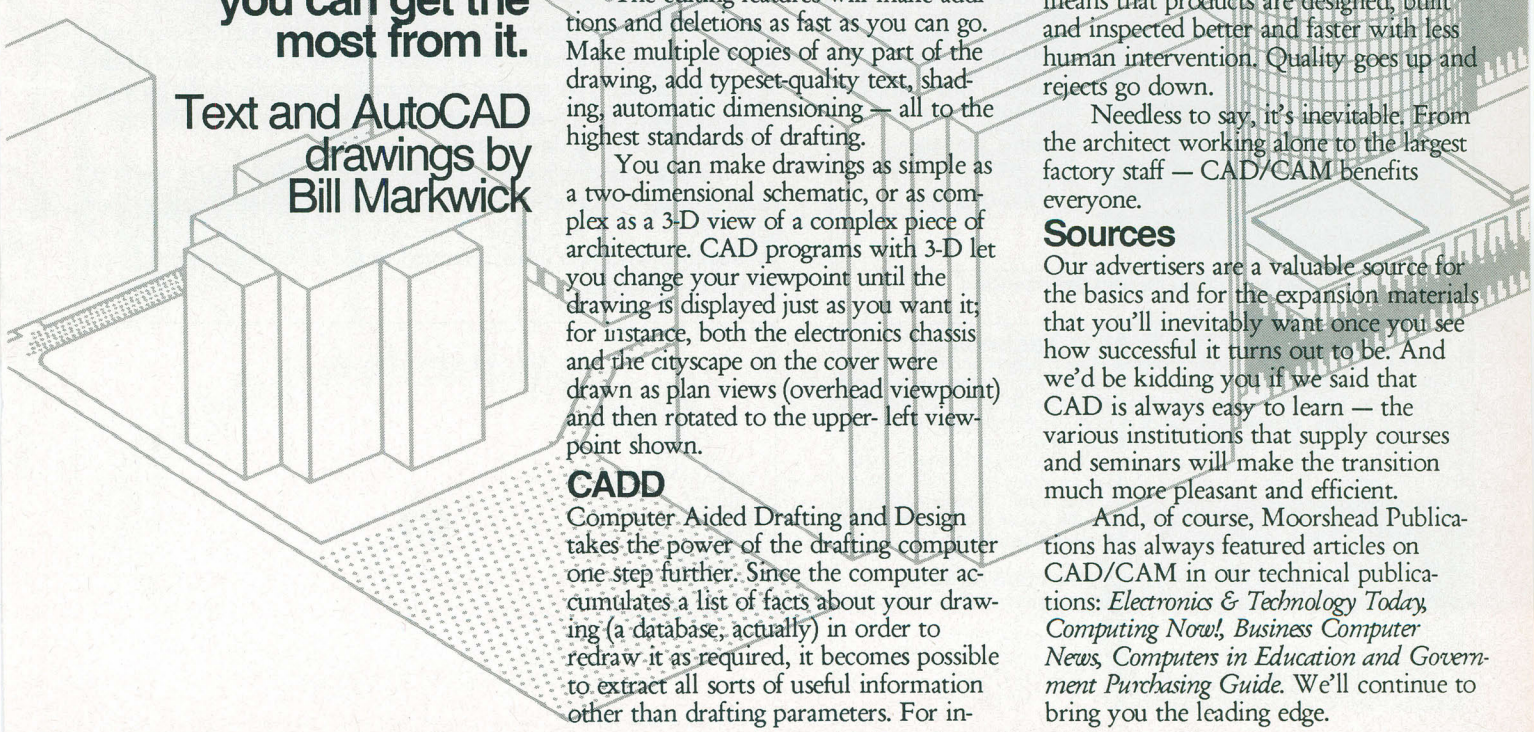
the present and future of CAD/CAM

Covering the basics of this amazing application - and how you can get the most from it.

Text and AutoCAD drawings by Bill Markwick



In the last few years, we've had a quiet but huge revolution going on: the growing power of microcomputers has brought Computer Aided Drafting/Computer Aided Manufacturing within everyone's reach. What used to require a room-sized mainframe can now sit on your desktop. What used to be slow and cumbersome in the early years is now fast, sophisticated software that's a delight to use. Here's a look at the basics of what people are doing with CAD/CAM and how you can benefit from it.

CAD

Computer Aided Drafting is the most popular application. Using a mouse or digitizer tablet, the user can draw just as if the screen were a piece of paper — but what a piece of paper! Most drafting programs let you zoom in and out with a range far greater than you could ever need (some programs include a sample drawing of our Solar System drawn *to scale*, and you can zoom in on fine details, such as the plaque on the Apollo lunar lander). Further, even massive corrections can be done quickly and easily. Parts of a drawing that are used over and over (such as the components in an electronic schematic) can be stored in a disk library and loaded into your drawing as needed. You never need to draw anything twice; just accumulate a disk library of your most-often-used objects. An architect, for example, could call up standard door and window symbols and insert them into any wall section as needed.

The editing features will make additions and deletions as fast as you can go. Make multiple copies of any part of the drawing, add typeset-quality text, shading, automatic dimensioning — all to the highest standards of drafting.

You can make drawings as simple as a two-dimensional schematic, or as complex as a 3-D view of a complex piece of architecture. CAD programs with 3-D let you change your viewpoint until the drawing is displayed just as you want it; for instance, both the electronics chassis and the cityscape on the cover were drawn as plan views (overhead viewpoint) and then rotated to the upper- left viewpoint shown.

CADD

Computer Aided Drafting and Design takes the power of the drafting computer one step further. Since the computer accumulates a list of facts about your drawing (a database, actually) in order to redraw it as required, it becomes possible to extract all sorts of useful information other than drafting parameters. For instance, it's possible to have some programs print out a parts list or a bill of materials, based on what parts you've used in the drawing.

It's not uncommon for CADD programs to have their own built-in computer language for your use. For instance, AutoCAD (which was used to make the cover drawings) contains a version of the programming language LISP. This lets you write your own commands, from simple ones that make little changes to complex programs that construct whole drawings to your specifications. You can also use them as a programmable calculator that will not only draw a component, but work out what value it should have.

CAM

Computer Aided Manufacturing is taking over industry, even small shops. The computer program can run the machines on the factory floor, keep track of inventory and parts locations, process and report on orders *versus* output, and even supervise the cutter movements of an unattended lathe.

CAD can now meet CAM, thanks to sophisticated software and digitally-controlled manufacturing machinery. For instance, you can now obtain milling machines with a digital inputs that can convert your CAD drawing into a precisely machined part or casting mold. From idea to design to finished part, all from your desk!

The Why of CAD/CAM

The precision performance of the computer (and the machines used in CAM) means that products are designed, built and inspected better and faster with less human intervention. Quality goes up and rejects go down.

Needless to say, it's inevitable. From the architect working alone to the largest factory staff — CAD/CAM benefits everyone.

Sources

Our advertisers are a valuable source for the basics and for the expansion materials that you'll inevitably want once you see how successful it turns out to be. And we'd be kidding you if we said that CAD is always easy to learn — the various institutions that supply courses and seminars will make the transition much more pleasant and efficient.

And, of course, Moorshead Publications has always featured articles on CAD/CAM in our technical publications: *Electronics & Technology Today, Computing Now!, Business Computer News, Computers in Education and Government Purchasing Guide.* We'll continue to bring you the leading edge.

the basic equipment

CAD/CAM programs, even fairly straightforward ones, put some rigorous demands on computer equipment. The drawing and database files are very large compared to, say, a paint program, because CAD stores each object you enter as a mathematical entity, not just a screen image.

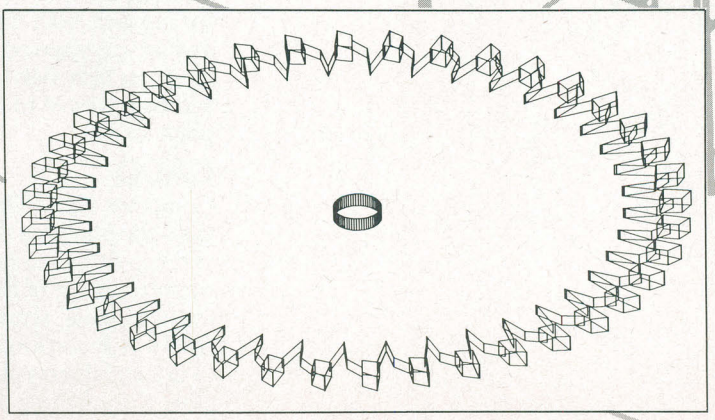
Because so much calculating has to happen before drawings appear on the screen (particularly if you Zoom and Pan a lot), the best advice is to buy as much computing power as you can afford. The two most popular systems for entry-level CADders would be the IBM AT (and compatibles) or one of the Macintosh models. A math co- processor is strongly advised (and mandatory for some programs). If you plan to make very complex drawings (and they can get as complicated as you care to make them), one of the 386 family of computers may be advisable.

Since you're going to be looking at very fine details on the screen, a VGA, EGA or high-resolution monochrome (Hercules or compatible). Color is very nice to work with; you can color-code various parts of your drawings, something that certainly eases looking at a complex group of overlaying lines. If you plan to do a lot of CAD, such as full-time architectural or manufacturing work, treat your eyes to one of the extra-high-resolution workstation monitors or VGA cards that can exceed 1000 pixels of horizontal resolution.

To enter your drawings, you'll need a mouse; almost any type will do, but higher precision pays off. If you want the best possible input system, a digitizing pad is recommended. These look like a mouse, but each point on the pad always corresponds to a point in your drawing — you can enter a hand-sketched drawing just by tracing over it, something that's too awkward to do with a conventional mouse.

To get your drawing out of the computer, you can use a regular dot-matrix printer for draft copies, a laser printer for first-rate (but small) printouts, or a plotter. Plotters can be purchased in whatever size you require; the drawing is usually done by a pen or pens controlled by servomotors, although very rapid thermal plotters are coming on the market.

To sum up: don't skimp on the equipment — you'll regret it later. Trying CAD on inadequate gear is rather like trying to learn the violin — on a $10 fiddle. You can't take advantage of many of the features, and you'll be frustrated at the slow response and cumbersome operation.

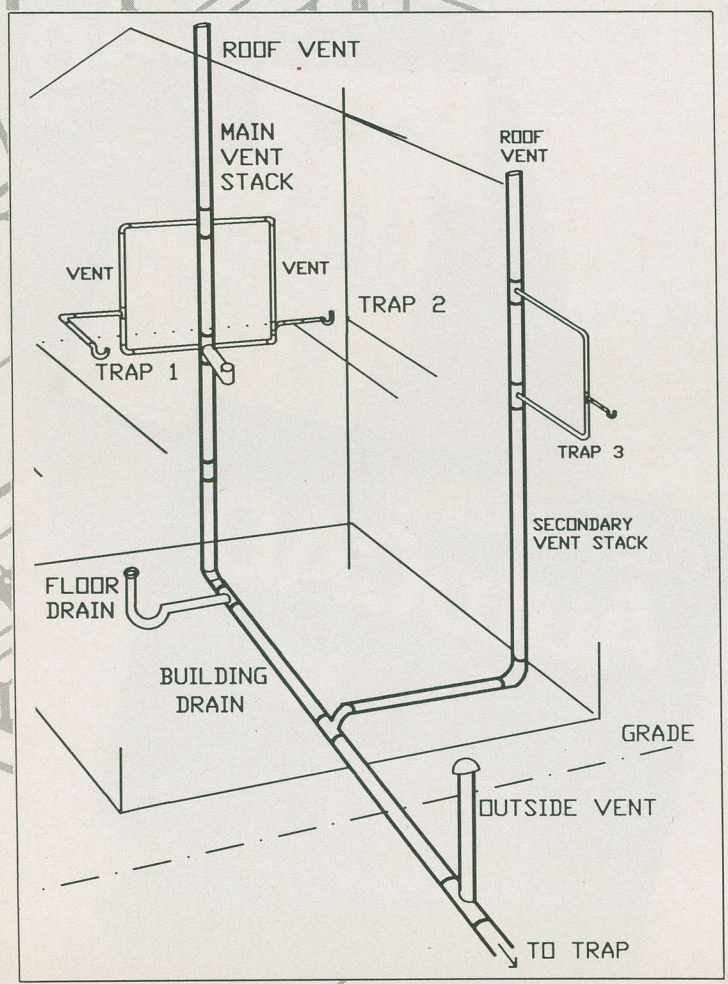


CAD and other programs

CAD software stores its programs as a database of mathematical entities. The big advantage that this gives to the user is the ability to share accumulated facts and figures with other programs. For instance, most CAD programs can write the database to a disk file in the DXF format; this is the drawing database converted to a textfile, and is rapidly becoming an industry standard for drawing file interchanges.

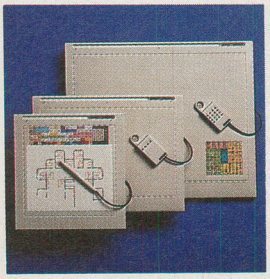
It's possible, for instance, to buy third-party software that can extract all sorts of information from your textfile: parts lists, bills of material, cost lists, etc. Furthermore, many of these lists can be imported into spreadsheets, such as Lotus 1-2-3. Third-party databases such as DBase III can be used to store and manipulate that statistics — which started as a drawing!

CAD programs (along with paint programs) are very useful to the publisher. Every desktop publishing program has a method of loading in illustrations from disk files. In the case of this particular publication, the drawings were done with AutoCAD Release 9, and then written to a floppy disk in the HPGL graphics language, a format that can be directly loaded into Ventura 1.1. Ventura then sized and scaled the drawings, loaded in the text and printed everything out on a laser printer.



CalComp Introduces NewProducts for CAD/CAM

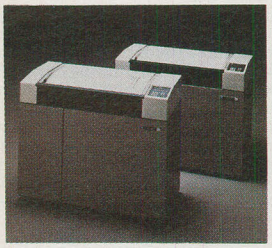
DrawingBoards



CalComp offers high-quality, professional graphic input devices for drawing, mapping, desktop publishing, animation, and presentation graphics. In sizes ranging from 12" x 12" to 60" x 44", these units have a host of user-requested features and a selectable resolution of up to 10,160 lines per inch, and are supported by the most popular CAD and graphics software packages. The transducer may be either a 4- or 16-button ergonomically designed cursor or a pen stylus. Industry-standard interfaces are featured in every model.

Circle No. 78

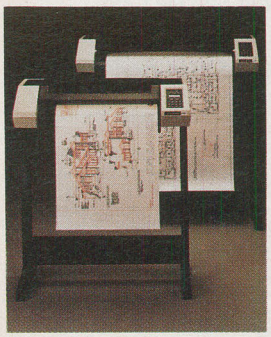
Electrostatic Plotters



Model 5733 and Model 5735 Elecrostatic Plotters deliver high- resolution monochrome plots with an exclusive CalComp feature, "Quickplot", which doubles plotting speed. These plotters are ideal for CAD applications such as architecture, mechanical and electrical design, and geophysical mapping. An exclusive Enviroclean toning system is not vented to the atmosphere. Both models support a wide range of interfaces and software, and as many as four RS-232-C data sources can be linked with the plotters simultaneously.

Circle No. 79

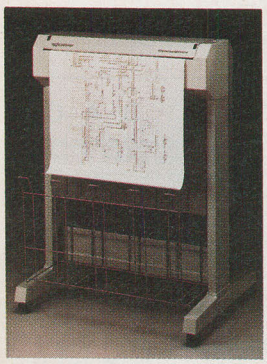
Low-Cost Artisan Pen Plotters



CalComp's 1020 Series are high-performance pen plotters at affordable prices. Two models, the 1023 and the new 1025, can plot on media larger than ANSI-D/ISO-A1 (Model 1023) or ANSI- D/ISO-A0 (Model 1025), and have plotting speeds as fast as 42" per second with an acceleration rate of up to 2.8g's. Second generation Plot Manager firmware substantially increases the Artisan's throughput by minimizing pen movement and pen changes. A new vector "look-ahead" feature keeps the pen moving at high speed when a line changes direction 45° or less. The Artisan family enjoys extensive CAD hardware and software support.

Circle No. 80

Direct Imaging Plotter



CalComp's DrawingMaster Model 52224 is a low priced high- performance plotter that uses direct imaging technology to produce one- or two-colour drawings, and is capable of sorting vectors, generating lines and area fill, and rasterization. DrawingMaster model 52224 can produce a D/A1 drawing in less than 20 seconds, and can be linked with as many as 4 workstations at once. The plotter is compatible with most CAD hardware platforms and with over 100 CAD/CAE software packages including AutoCAD, VersaCAD and others. Toner-free operation makes a safer environment and easy maintenance, with no pens to run dry, no ribbon to run out, and no chemicals to add or replace.

Circle No. 81

CalComp Canada Inc.
401 Champagne Dr., Downsview, Ont. M3J 2C6
Ph: (416) 635-9010; FAX: (416) 633-5103

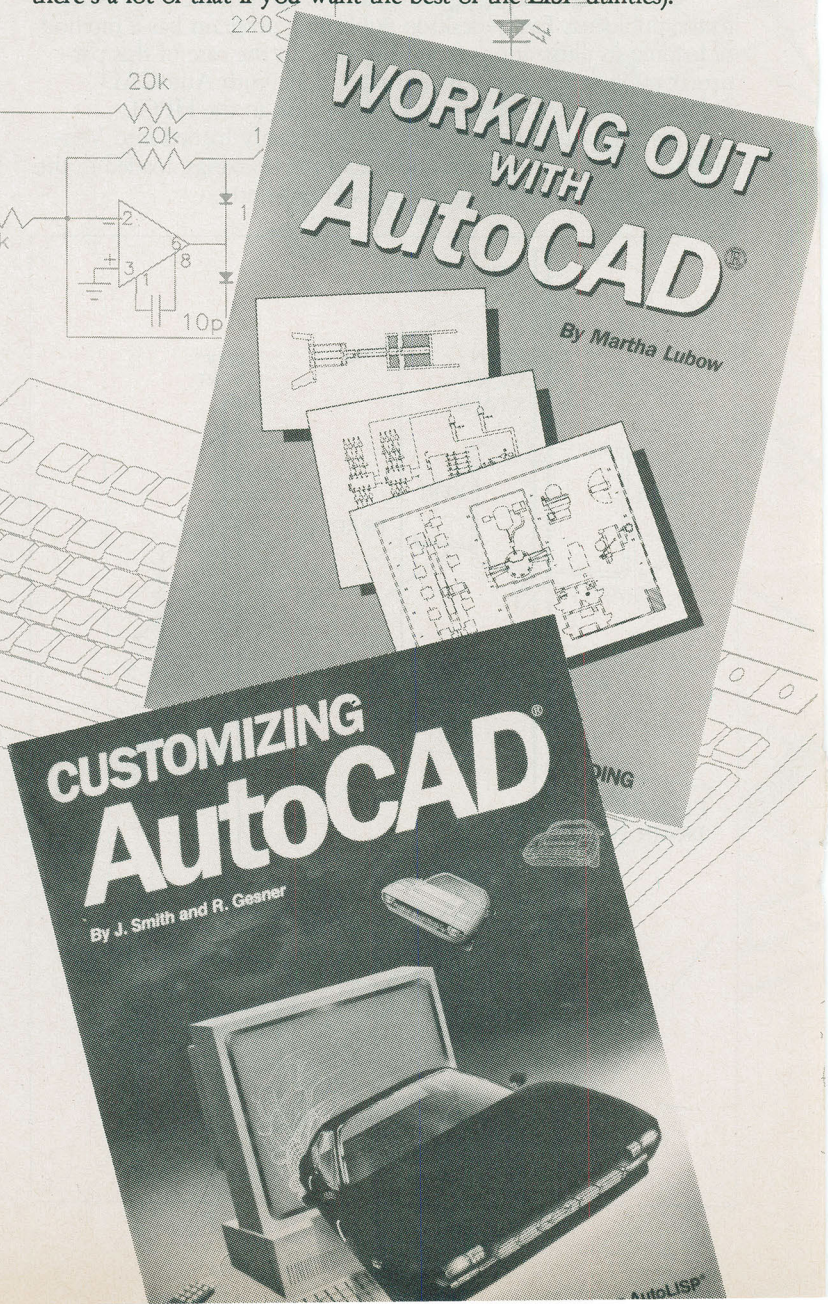
autoCAD books

Working Out With AutoCAD

Martha Lubow, New Riders Publishing, Thousand Oaks, California 91360. New Riders publish quite a few excellent books on AutoCAD, and this is one of them. It's not just another rewrite of the reference manual, but a tour through a number of drawings that shows efficient ways to solve drawing problems. New Riders books are available at most major bookstores.

Customizing AutoCAD

J. Smith and R. Gesner, New Riders Publishing. This huge softcover is one of the very few books to explain the real workings of AutoCAD's custom menus, macros, AutoLISP, and much more. It's inspiring. Unfortunately it's something of a programmed course — you can't just dip in anywhere because many of the examples depend on previous work. Still, you can order a set of disks that eliminate having to type things in (and there's a lot of that if you want the best of the LISP utilities).



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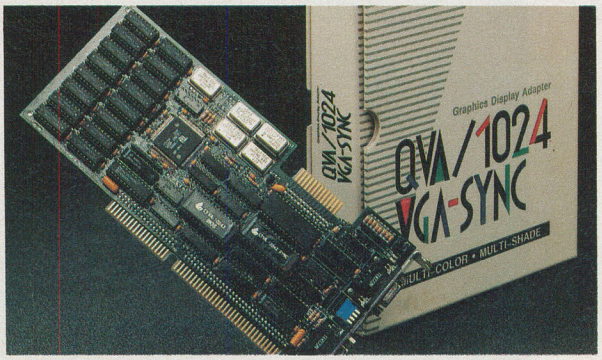

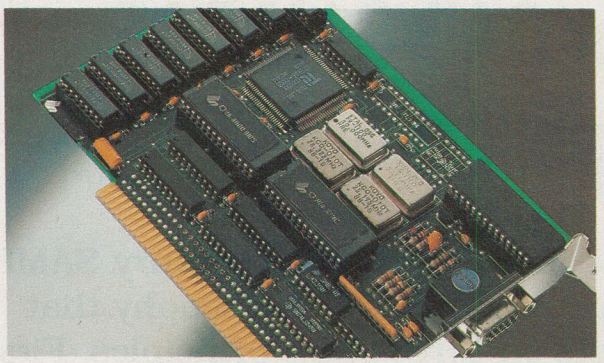

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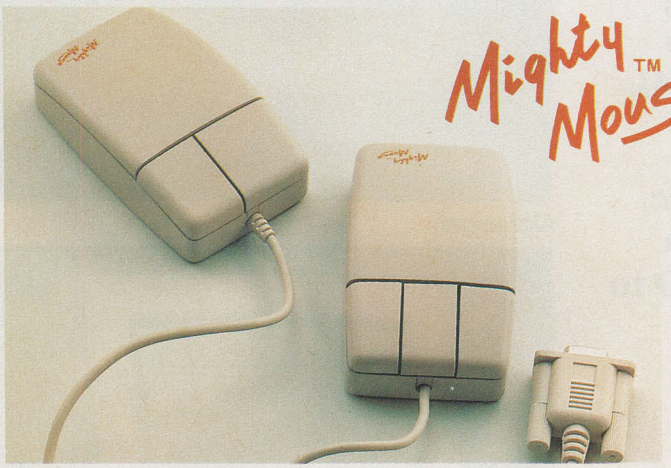

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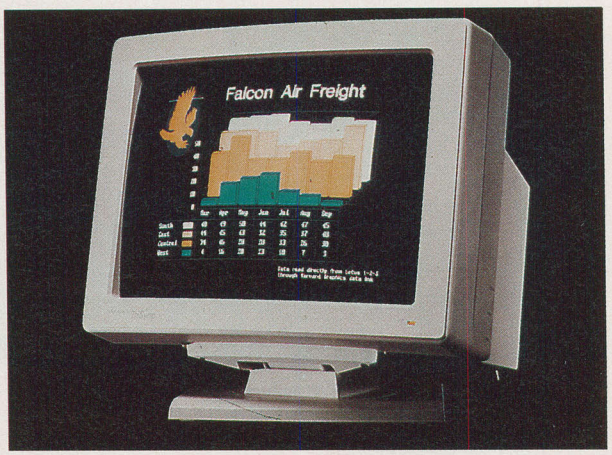

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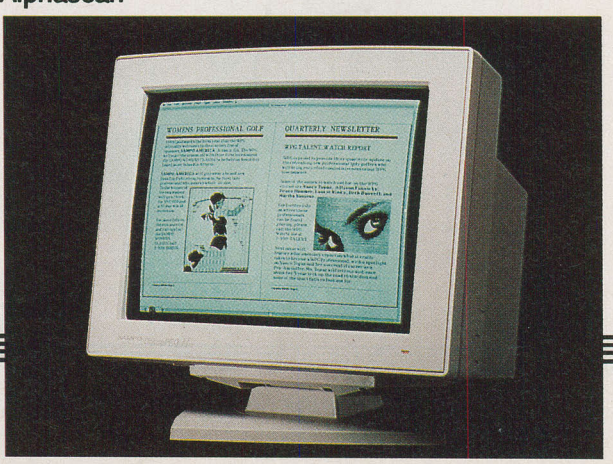

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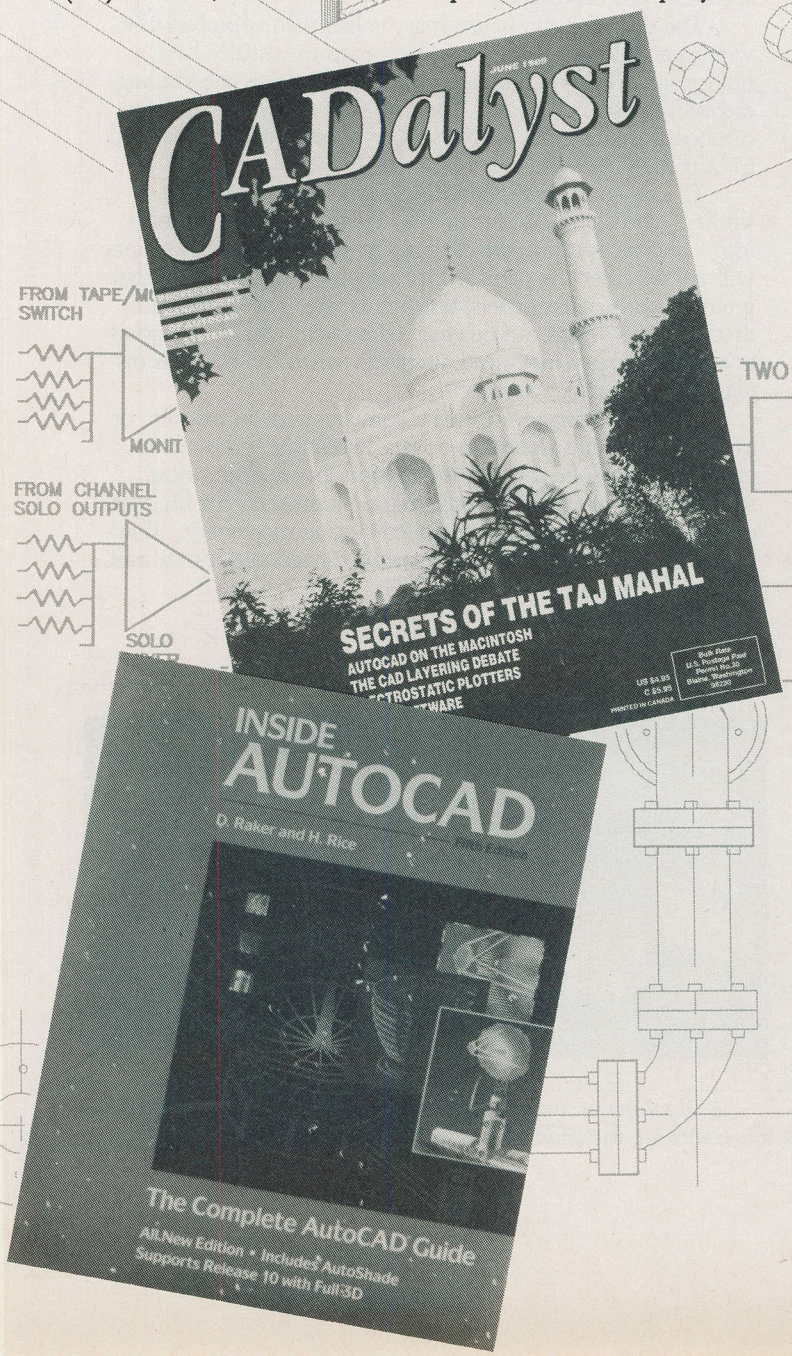
autoCAD books

Inside AutoCAD

D. Raker and H. Rice, New Riders Publishing. A fine tutorial that clarifies many of the points in the reference manual. This one was popular for quite a while, and is now completely updated into a new edition that includes Release 10's full 3-D. Good examples of Attributes and Dimensioning.

CADalyst Magazine

A Canadian monthly that's essential reading for anyone who works with AutoCAD, whether it's full-time or occasionally. It features hardware and software reviews (usually from several viewpoints), AutoLISP tutorials, beginner's sections, industry discussions, and more tips and techniques than you can shake a digitizer at. 202-210 W. Broadway, Vancouver, BC V5Y 3W2, (604) 873-0811, Fax 873-5888. Subscriptions are $42 Cdn per year.



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CAD and 3d

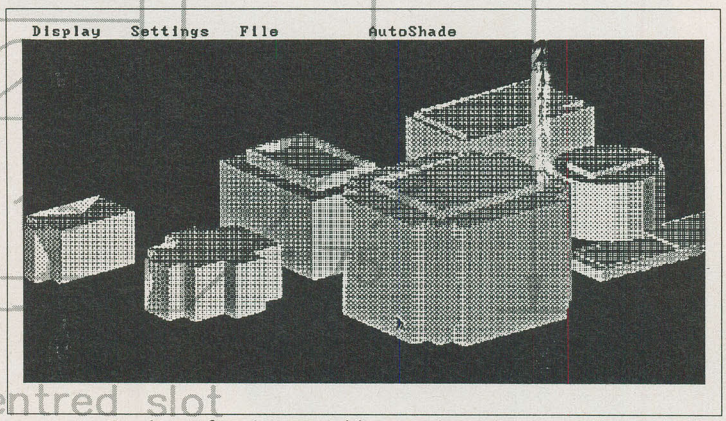
The additional of true three-dimensional drawing functions to CAD programs has meant the releasing of real design power. Not only can you view the finished product from any angle, but you can use utility programs to apply shading, move the light source around, etc.

Two applications that benefit from 3D would be (among many others) architecture and electronic packaging. The architect can lay out a plan drawing (overhead view) and the software will add the necessary elevations. The completed project can then be shown to the client from any angle: front, rear, upper right, upper left or anywhere in between. With the appropriate software, it's possible to do a "walkthrough", in which the viewpoint is that of a person walking in the front door and then turning left or right to inspect the various rooms.

The drawing of a house may be less than appealing as a wireframe (like an X-ray view), so programs usually have a hidden-line-removal function, and even better is the shading capability described above. The user may still prefer to have cardboard models, but for versatility of presentation, it's hard to beat the CAD utilities.

The designer working with electronic packaging (or similar) can use the 3D functions to place scale components into a chassis; rotating the drawing to give various viewpoints will tell whether the parts will fit properly, and whether they interfere with access panels, test points, etc. The general aesthetics of the design can be checked as well; what looks good as a head-on view may need alteration when the object is displayed from various angles.

The parts designer can see a complex part on its own, or as part of a whole assembly, or as a wireframe, or as a completely shaded solid-model presentation. In addition, most software can write the various object parameters to a file that can be read by computer-controlled cutting machinery, allowing milling and other operations to be carried out with a minimum of setup time.



A 3D view of a cityscape (shown elesewhere as a hidden-line-removal); the shading was done by AutoShade.

CAD as illustrator

The drawings of the camera on the next page were done as part of an in-house documenting of photo studio facilities, and demonstrate the use of a CAD program together with desktop publishing. Although it looks complex and appears to be brimming with detail, the drawing of the camera was done in less than two hours. The right half is largely a copy of the left half, done by using functions such as multiple copying, mirroring and moving.

The shading on the front of the camera was done with the Hatch function, a far cry from proper graduated shading, but adequate for the purpose. Text was the normal font supplied with AutoCAD.

To load the drawing into Ventura for the final page makeup, AutoCAD was used to plot the drawing file to a disk in the HPGL mode (the Hewlett-Packard Graphics Language, available in every CAD package). Ventura can load this file directly into a page layout, converting it to a GEM file as it goes.

The final picture is set on the page with the desired size, margins, ruling box, etc. Additional text can be added as needed with Ventura.

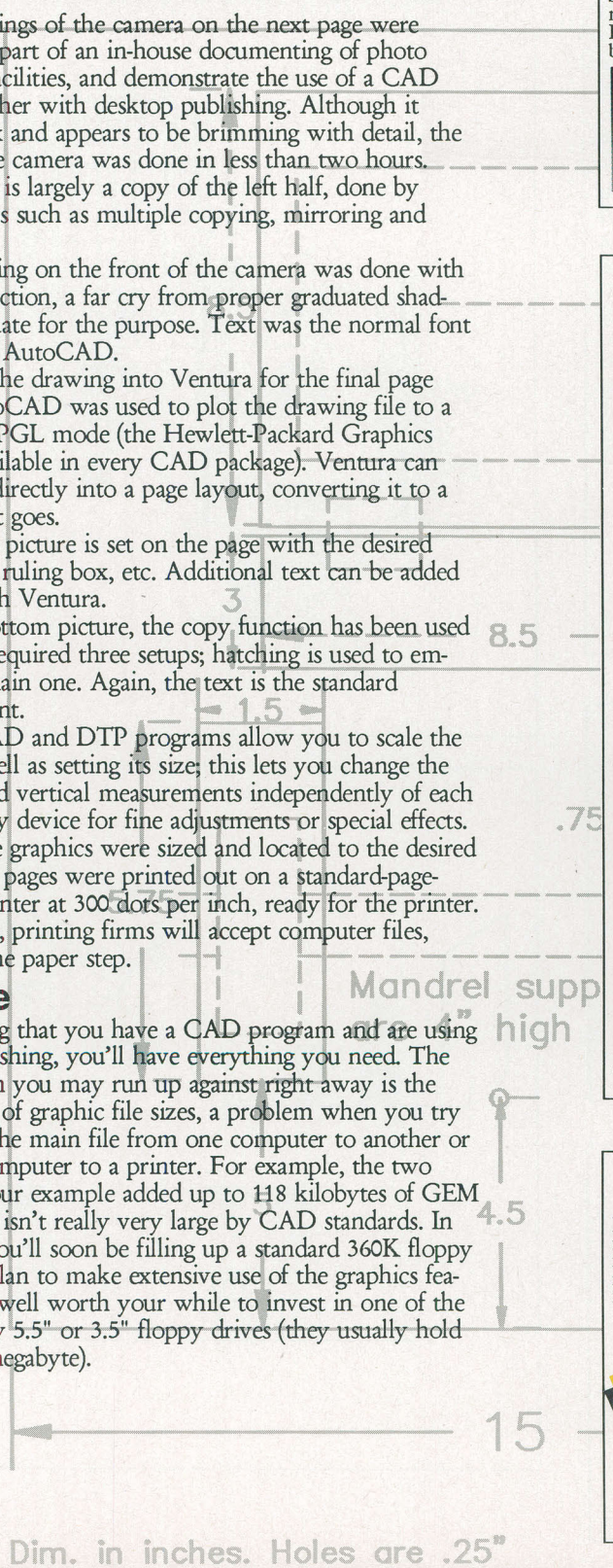
In the bottom picture, the copy function has been used to draw the required three setups; hatching is used to emphasize the main one. Again, the text is the standard AutoCAD font.

Most CAD and DTP programs allow you to scale the drawing as well as setting its size; this lets you change the horizontal and vertical measurements independently of each other, a handy device for fine adjustments or special effects.

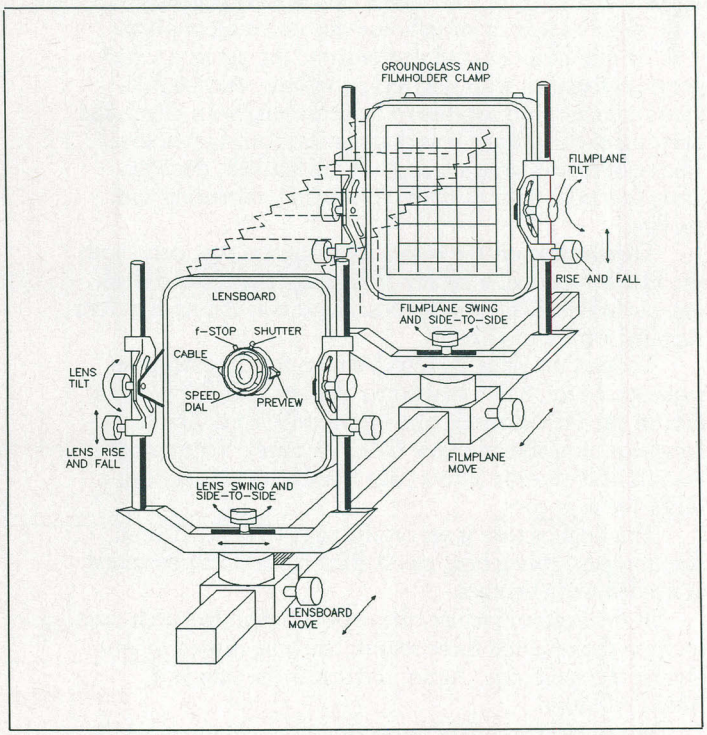
Once the graphics were sized and located to the desired positions, the pages were printed out on a standard-page-sized laser printer at 300 dots per inch, ready for the printer. In some cases, printing firms will accept computer files, eliminating the paper step.

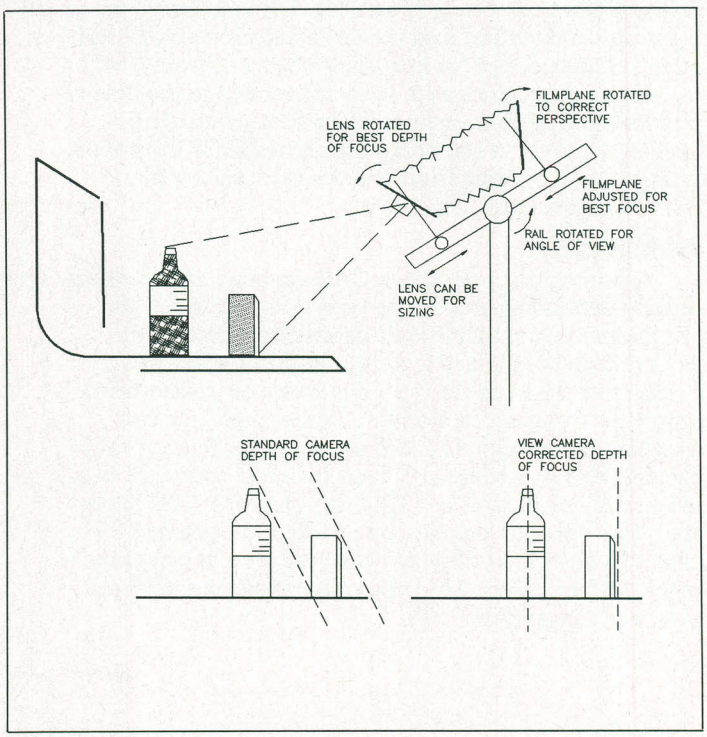
Hardware

Assuming that you have a CAD program and are using desktop publishing, you'll have everything you need. The one limitation you may run up against right away is the rapid growth of graphic file sizes, a problem when you try to transport the main file from one computer to another or from your computer to a printer. For example, the two drawings in our example added up to 118 kilobytes of GEM files, and this isn't really very large by CAD standards. In some cases, you'll soon be filling up a standard 360K floppy disk. If you plan to make extensive use of the graphics features, it'll be well worth your while to invest in one of the larger-capacity 5.5" or 3.5" floppy drives (they usually hold well over a megabyte).



CAD as illustrator





As described in the text on CAD as illustrator, the two images shown were done with extensive use of copying and mirroring, eliminating much of the drawing and re-drawing that would be required with hand work.

The hatch patterns, while not quite up to the versatility of the Fill feature of paint programs, are adequate for the purpose.

Once the drawing was completed, it was written to a disk file in the Hewlett-Packard Graphics Language (HPGL) by selecting any HP plotter as the output device. Ventura Publisher could then load, size and scale the HPGL file by converting it into a GEM file and loading it into a frame.

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ALMOST FREE SOFTWARE

V O L U M E — 5 1

If we were IBM or Xerox we'd have raised the price for this collection of programs. If you own a computer... even if it's broken... you'll find things in here to craze your brain with a lust for phosphor, applications programs and dead aliens. With everything from helpful little utilities to serious applications to one of the best games ever written, this disk has something for everyone.

This collection contains a complete drawing package which while not as powerful as AutoCAD is also nowhere near as hardware or cash hungry. It's also a lot easier to use. There's also POLY, a great little music system. You'll want to check out our DOS utilities, some of which are so good as to be indispensable. Finally, if you have a VGA card we're certain you'll be every bit as blown away by BANANOID as we were. It's the most stunning game available for a PC, commercial or otherwise.

Every program on this disk has been extensively checked to make sure that it functions as it should and that it contains no viruses or other nasties. Most sources of public domain software do not provide you with this assurance.

This disk carries the same promise that all our Almost Free Software does. If you don't feel that it's fair value once you've checked it out, we'll buy it back from you with no gripes or questions. If you have problems with it, our help desk is as near as your phone... just call (416) 445-5600. If you're not already receiving it, please call us and ask to be put on the mailing list of Personal Software News, our newsletter. It's free.

Note that this is a two disk set containing over a megabyte worth of code. Sorry for the slight price increase... we're certain you'll agree it's worth it.

ASCI is a great resident program for applications which require that you enter extended character codes into them. Rather than having to remember what the code for a U with an umlaut over it is, just pop up this window and select it from a table. Great for word processing.

DRAFTC is like AutoCAD without the price tag... and it doesn't need a math chip. This is a complete drafting package with pull down menus, mouse support and lots of features. It's great for applications in which you don't need all the power of a high end drawing program. Requires a mouse.

POLY is a really elegant little three voice music playing program which lets you compose songs with a text editor or word processor and halve them played through your PC's speaker in up to three voices. Sample songs are included.

TRICAL is the most sophisticated pop up calculator program yet devised. Outthinking SideKick and all the commercial calculators, this one will do things even real calculators can't get together.

BANANOID is staggering. It's a VGA game which makes Breakout not only interesting but addictive. Words fail to describe the limitless time wasting potential of this thing. If you own a VGA card and a mouse and go through this life never having play Bananoid, all future incarnations of your spirit will laugh at you behind your collective backs. Requires a VGA card and a mouse.

CLIP allows you to extract sections of GIF files and make them into new, smaller GIF files. It's a great tool if you use our POSTGIF program to create desktop publishing clip art from GIF files.

EGAINT is the last word in Tetris programs. The ultimate falling shape puzzle, this features colour, extended shapes and a plethora of exciting features. Requires an EGA card.

FREEMEM is a little Windows program which puts a window on your screen to tell you the current amount of free memory available to your applications. No computer should be without one. Requires Windows.

NTERNIST is a fascinating and oftentimes useful package to help you figure out... if not cure... what ails you. Give it your symptoms and it'll try to diagnose your condition. This is *not* a substitute for a real physician, but it's great if the provincial health care plan has put you at the back of the waiting list.

PUZZLE is a Windows program which takes one of several graphics, scrambles it into little bits and challenges you to re-assemble it. Quite a decent little program, this. Requires Windows

SUBMIT is an instant batch file. It allows you to run multiple commands at one time from the DOS prompt simply by separating them with colons. An essential gadget, this.

TIME puts a digital clock into a Windows screen. It takes up a lot less space than the one with hands does, and it looks slick. Requires Windows.

TODDY is a DOSEDIT replacement. It adds a sophisticated command line editor to DOS to allow you to recall and edit previous commands. Saves buckets of typing and uses WordStar editing commands.

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VOLUME 50

This month, we wanted to say 'thanks' to everyone who's bought our Almost Free Software collections thus far, so we created a special collection of programs. This month, we've put together a two disk set... over a megabyte of software when it's all unpacked. However, the price only reflects the cost of one extra blank floppy and a few stamps. It's our way of telling you how much we appreciate your support of our software.

This month's collection of programs is diverse. It includes such things as a set of desktop publishing text ornaments, a couple of first class weird games and some utilities you won't want to be without. For those users with more karma than things to do, we've also included CUBE, our all time favourite useless Windows program.

And there's a whole lot more in this month's collection.

Every program on this disk has been extensively checked to make sure that it functions as it should and that it contains no viruses or other nasties. Most sources of public domain software do not provide you with this assurance. This disk carries the same promise that all our Almost Free Software does. If you don't feel that it's fair value once you've checked it out, we'll buy it back from you with no gripes or questions.

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BAK will wander through your entire hard drive... every subdirectory, no matter how well buried it might be... and wipe out your BAK files. Reclaim countless megabytes of wasted space.

CHAIN will tell you how much space any file on your disk occupies. This sounds like much ado about nothing, but CHAIN actually tells you how many clusters a file occupies, and, for the technically curious, where said clusters lie.

CUBE is a useless program that runs under Windows and displays a constantly rotating three dimensional cube. Despite its uselessness, everyone we know who has it runs it a lot... no idea why. Requires Windows.

DUNGEON is an ASCII game that lets you cruise through a complex, multiple layer dungeon picking up things and killing creatures. Requires that ANSI.SYS be installed.

IBM_SCRN is a downloadable character set for the Epson FX printers... and all compatibles... which emulates the PC's screen graphics characters. Make your screen dumps look like screen dumps rather than ASCII stew.

JOT-IT is the most flexible, interesting little resident note pad program we've come across. Loaded with features, it will find a warm place on your hard drive... right next to the platter bearings.

MINDREADER is the oddest word processor ever written. Especially designed for people who don't type too quickly, it uses artificial intelligence to attempt to anticipate what you'll say and fill in things for you. It sounds a bit far fetched, but the beast works.

POSTGIF is the latest version of this powerful program for turning GIF files into desktop publishing clip art. Now features variable size halftone screens for better reproduction.

PURGE is a handy little utility for selectively deleting files.

QCRT will speed up the screen speed of most machines by quite a bit. This makes DOS and many other programs which print through the BIOS really shift into overdrive.

SLITHER is a version of the popular snake game written especially for the EGA card. It's a bit warped, too... there's a frog involved. Requires an EGA or VGA card.

SPEED will speed up the screen display of an EGA or VGA card even better than QCRT, above. Includes the ASM source in case you like to hack.

CHEMVIEW is neat even if chemistry usually bores you into catatonia. It displays complex molecules in three dimensions and rotates them for you. Includes sample molecules. Requires EGA or VGA card.

FONTINFO is a DIR replacement that only wants to know about LaserJet soft fonts. It will find all of the soft fonts in a directory and tell you about them.

DROPCAPS consists of twenty six little PCX files, that can be inhaled into Ventura, PageMaker... any package that uses the popular PC Paintbrush image file format... to provide you with beautiful, ornate large caps from A through Z.

THESAURUS is a computerized thesaurus program. Give it a word and it'll find you a selection of others that mean something like the same thing. Includes a huge dictionary.

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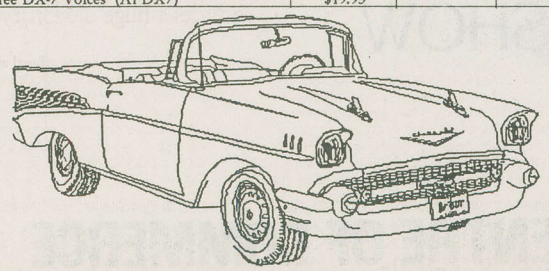

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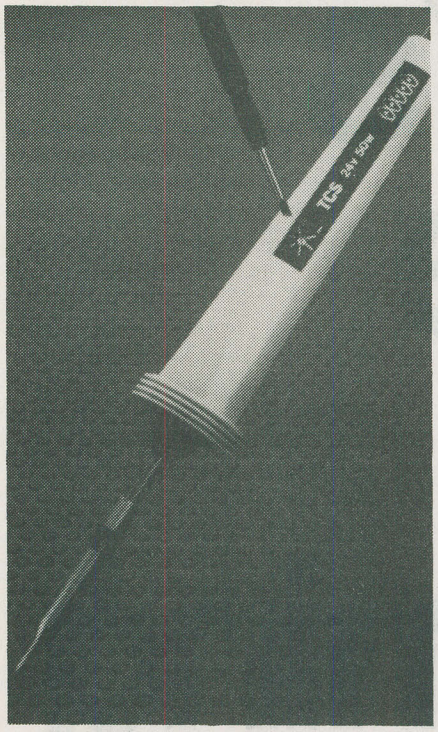
 Continued from page 20

T.C. Soldering Iron



The Antex Model TCS Temperature Controlled Soldering Iron features a temperature control screw in the handle for convenient adjustment from 392°F to 842°F. It has zero voltage switching and comes in a model for 110VAC or one for all popular 24V sources. M.M. Newman Corporation, 24 Tioga Way, PO Box 615, Marblehead, MA 01945, (617) 631-7100, fax 631-8887.

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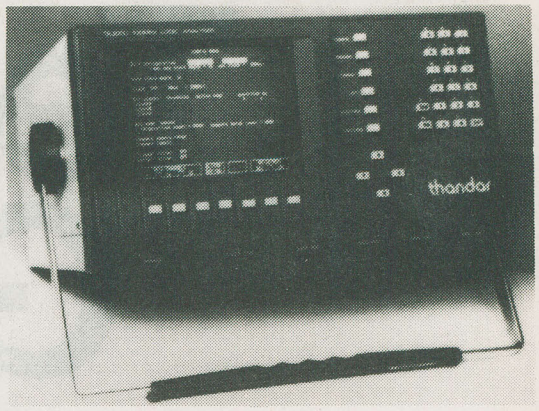

Thandar Electronics announces the availability of a low-cost portable logic analyzer, the TA-2000. It can capture data across 32 channels (at 25MHz) or 8 channels (100MHz); data is displayed in both Timing and List formats on the 7" CRT. It also features 5nS glitch capture and triggering. Omnitronix, #4-2410 dunwin Drive, Mississauga, Ontario L5L 1J9, (416) 828-6221, fax 828-6408.

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The new Model 865 Multitester from Brunelle features high input impedance, large dial, overload protection, and a single range switch with 43 ranges. It reads DC and AC volts to 1200, DC and AC current to 12A, all with a basic accuracy of 2.5%. Brunelle Instruments, 73-6th Range South, St-Elie-d'Orford, Quebec J0B 2S0, (819) 563-9096, fax 569-1408.

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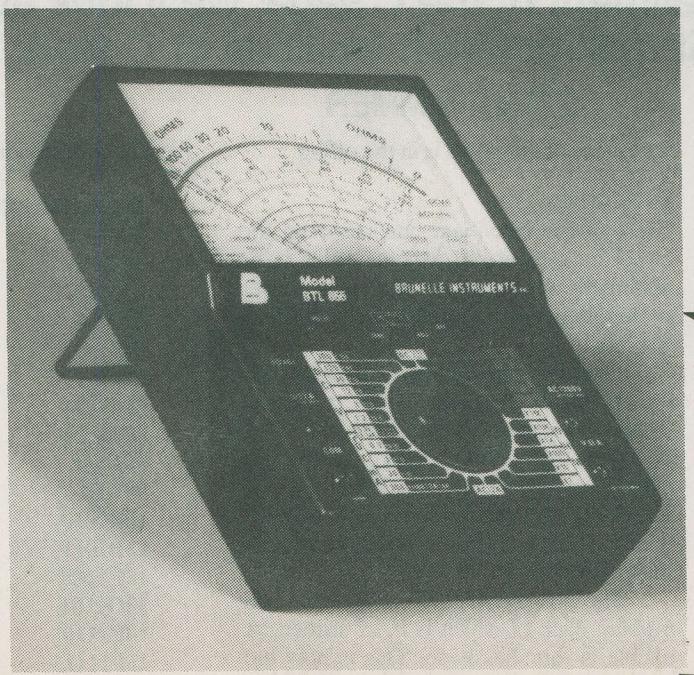

FEATURE

Techie's Guide to C Programming Part 9

Bytes are fairly easy to cope with. Bits are decidedly nastier. In this installment of the C saga, we'll look at how the bit manipulation facilities of C work.

STEVE RIMMER

Bytes are, of course, composed of bits. Most dogs can tell you this if they're suitably inspired. However, whereas the relationship of bytes to the universe is a fairly obvious one, that of their component bits is not. Working with data at the bit level is tricky. It's not something which BASIC gives you any facilities at all for, and, as such, you may not have tried to do it.

Bitwise manipulation is a tremendously useful tool for all sorts of program applications, but it's very nearly essential for dealing with DOS, which... being basically an assembly language environment... casually flings its bits around with wild abandon.

This month we're going to get a handle on how C copes with bits. Needless to say, more punctuation is in the offing.

C Scapes

Most of the bytes you encounter on the street have eight bits in 'em. While basic arithmetic operators do not allow you to manipulate these directly, they all affect the bits.

Under C on the PC, the *char* data type is effectively a byte. An *int* is a word, or two bytes, and C is very flexible in interchanging these two. Allowing that *a* is a *char* variable, if we say *a = 255*, all the bits in *a* will be set, that is, they'll all be one. It's a lot easier to see this in hex notation, actually. Let's say *a = 0xff*.

The hex number FF consists of two *nybbles*, each of which is F, or sixteen. A nybble is four bits wide. This is how the bits in a nybble work.

Decimal	Hex	Binary
0	0	0000
1	1	0001
2	2	0010
3	3	0011
4	4	0100
5	5	0101
6	6	0110
7	7	0111
8	8	1000
9	9	1001
10	A	1010
11	B	1011
12	C	1100
13	D	1101
14	E	1110
15	F	1111

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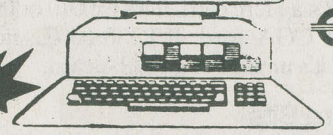

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As you can see, the sixteen permutations of a nybble involve all the possible bit patterns. As long as you can remember the bit patterns for the sixteen hex digits from zero through F, you can work out the bit pattern for a byte shown in hexadecimal notation.

Now, there are some basic bit manipulation techniques which C offers us, and they prove to be very useful. Let's start with the simple binary operators.

The most commonly used bitwise operator under C is the AND operator, &. To begin with, you have to be careful not to confuse it with the logical AND operator, &&. If we say something like

```
if(a == 6 && cat == dead) ...
```

we are using the *logical* operator. The bitwise operator is different.

Let's consider the result of six AND three. The kids'll tell you that it's nine. In fact, it's two. No amount of head scratching will work out how that came to pass, however, unless you understand bitwise arithmetic.

If you AND two numbers together, the resulting number will be one in which any bits common to the two numbers are set. As such, six, which has the bit pattern 0110 and three, which has the bit pattern 0011, AND together to form the bit pattern 0010, or two.

Under C would say something like this:

```
a = 6 & 3;
```

The AND operator is very often used for masking off unwanted bits. For example, if you use the *biosequip* function of Turbo C, you'll be able to tell all sorts of useful things about the hardware that your program is running on. One of these very useful things is the type of video card being used. The video card type is held in the fourth and fifth bits of the integer returned by this function. The other bits hold other information, which we aren't concerned with here. Let's start by doing this:

```
a = biosequip() & 0x0030;
```

The number being ANDed with the *biosequip* value masks off all but the fourth and fifth bits. Check out the bit table above if you aren't sure why this is.

Here's what the two remaining bits mean.

Bits45
00Unused (EGA)
0140 Column CGA
1080 Column CGA
11Hercules card

If *a* is 0x0030, that is, if both bits are set, it's a Herc card. If it's 0x0010 or 0x0001 it's a CGA card. If it's 0x0000... no bits set... it's unused or an EGA card.

More Bits

The next most common bitwise operator is OR, which is handled under C by the | symbol. Again, there's a logical OR, ||, which should not be confused with its bitwise cousin.

If you OR two numbers together, the resulting number will have its bits set where set bits existed in either of the two source numbers. Thus, six OR three would be seven... that's 0110 OR 0011, which gives you 0111. In C, we would say

```
a = 6 | 3;
```

The XOR, or "exclusive OR", operator toggles bits. It's handled by the ^ symbol. If we XOR a number with a second number, any set bits which are common to the two will be toggled in the first number. As such, six XOR three gives us four... that's 0110 XOR 0011. The second bit in the second number toggles the second bit in the first, leaving us with 0100.

The XOR operator is useful in doing bit mapped graphics, among other things, although, as most C compiler packages come with graphics libraries, you'll probably never have to use it for this. It's also good for dealing with the machine language interface which C provides for the PC. We'll be looking at this in a future installment of this series.

Finally, there's the NOT operator, handled by the tilde character. That's one of these, ~. This simply inverts all the bits in its destination. For example, the result of NOT 1 is 0xfe. You might write that as:

```
a = ~1;
```

In addition to manipulating bits, C lets you change their positions within a byte by *shifting*. Shifting involves moving all the bits in a byte to the right or the left by a defined number of positions. The shift operators, < to shift left and > to shift right, work like this:

```
a = 1 < 2;
```

In this case, we have shifted the number one, 0001 in binary, left by two positions, making it 0100, or four. If we did this:

```
a = a > 2;
```

it would be one again.

Shifting an integer to the left by one place is equivalent to multiplying it by two. Shifting it to the left by two places multiplies it by four, and so on. This is a good thing to know, as multiplication takes an awful lot longer than bit shifting. Some compilers automatically substitute bit shift operating where they can be used in place of multiplication when they're optimizing your code, but there are a lot of cases wherein this doesn't happen unless you make it happen.

Shifting bits right is equivalent to division in the same way.

But is it Useful?

There are all sorts of practical uses for bitwise operations under C. Let's start with a simple example.

We're going to write a game here. I don't exactly know what the object of it is... it's kind of irrelevant... but it's played on a sixteen by sixteen grid with pennies. Actually, pennies are too small... we'll use loonies, which aren't worth a whole lot more. In this game, any square on the board can be occupied by a loonie or it can be blank. We need a way of storing the condition of each square in memory.

This would be the obvious way.

```
char game_board[16][16];
```

This would create an array of *char*s, with one *char* per square on the board. If a square is occupied, its corresponding element in the array would be non-zero.

This approach is easy, but that array sucks back a quarter of a kilobyte. More to the point, seven eighths of it is redundant. We're using eight bits per element for a binary condition... only one bit is really needed.

Here's a better approach using a bitwise approach.

```
unsigned int game_board[16];
```

This requires thirty two bytes. If the game calls for the board to be initially empty, we would initialize this array as follows.

```
for(i=0;i;++i) game_board[i]=0;
```

Now, let's see how we would place a loonie on the board, that is, how we would set a bit in this array. We'll allow that each *int* in this array represents a vertical row on the board, and the bit position represents the horizontal position in that row. We want to place a loonie on square six of row twelve. Note that both the row and column numbers start at zero. This how it's done.

```
game_board[12] |= (1 < 6);
```

The notation "|=" may be a bit confusing. The above line is equivalent to this:

```
game_board[12] = game_board[12] | (1 < 6);
```

What we've done here is to create a "mask" which represents the bit position in the twelfth element of the array equivalent to the sixth place across. This is easy to see... we've just taken one, which is the first bit set, and marched it across by six places. We then OR it with the integer in question. If the position had already been filled by a previous loonie, nothing would happen. However, as the bit is unset... since we initialized the array to zero... the OR operation sets the bit to one.

Suppose our game called for toggling the status of the squares on the board, such that if one loonie was placed atop another both were removed from the board. We could do this with the XOR operator, like this:

```
game_board[12] ^= (1 < 6);
```

Finally, we could test the status of any element in the array with the AND operator.

```
if(game_board[12] & (1 < 6)) ...
```

This might be a bit obtuse at first. If the bit in question was set, ANDing the integer with our mask would result in an integer with one bit set. This would make it non-zero, and the condition would be true. If the bit was not set, any other bits in the integer would be masked off, and the result would be zero. The condition would be false. Note that here, we do not actually affect the contents of the array *game_board*, but only copy its contents out and manipulate them. In fact, C creates temporary variables to do this in, but we never see them.

Binary Breakdance

In practice, situations which call for bitwise manipulation occur quite frequently in programming. If you're used to writing in BASIC, you'll probably have encountered these and dealt with them in the sorts of convoluted ways that BASIC imposes on its users. C lets you get right down there and meddle with the bits, which is a great deal more flexible.

Assembly language is even more prone to using bitwise approaches to things. When we get into the assembly language interface in C, you'll find bitwise operators flung all over creation. ■

Of DACS, Dither and Compression

Covering the 1989 Audio Engineering Society meeting.

TIMOTHY B. PALMER-BENSON

The perfect sound forever axiom proclaimed so loudly for digital audio at its inception is undergoing re- examination and much development. Many papers presented at the four day international conference of the Audio Engineering Society (AES) in Toronto in May express concern about the audible distortion that the technology can produce with some types of digital signal processing (DSP). Concern is also being expressed about the quality of 16-bit and 18-bit DACs appearing in CD players. As a consequence, a number of solutions for preventing distortion in DSP are being proposed, most notably the use of dither, a form of white noise similar to the hiss generated in a hi-fi system.

The conference began with an historical account by Denon of how it had made the first commercial PCM/digital recording 17 years ago and how the company had improved its digital technology since then. Then, it was on to the first of two papers by Stanley Lipshitz and John Vanderkooy, two researchers at the university of Waterloo, in Ontario, who are widely respected for their work on A/D and D/A conversion and who were the among the first to offer scientific proof that all is not quite perfect in the world of consumer digital audio.

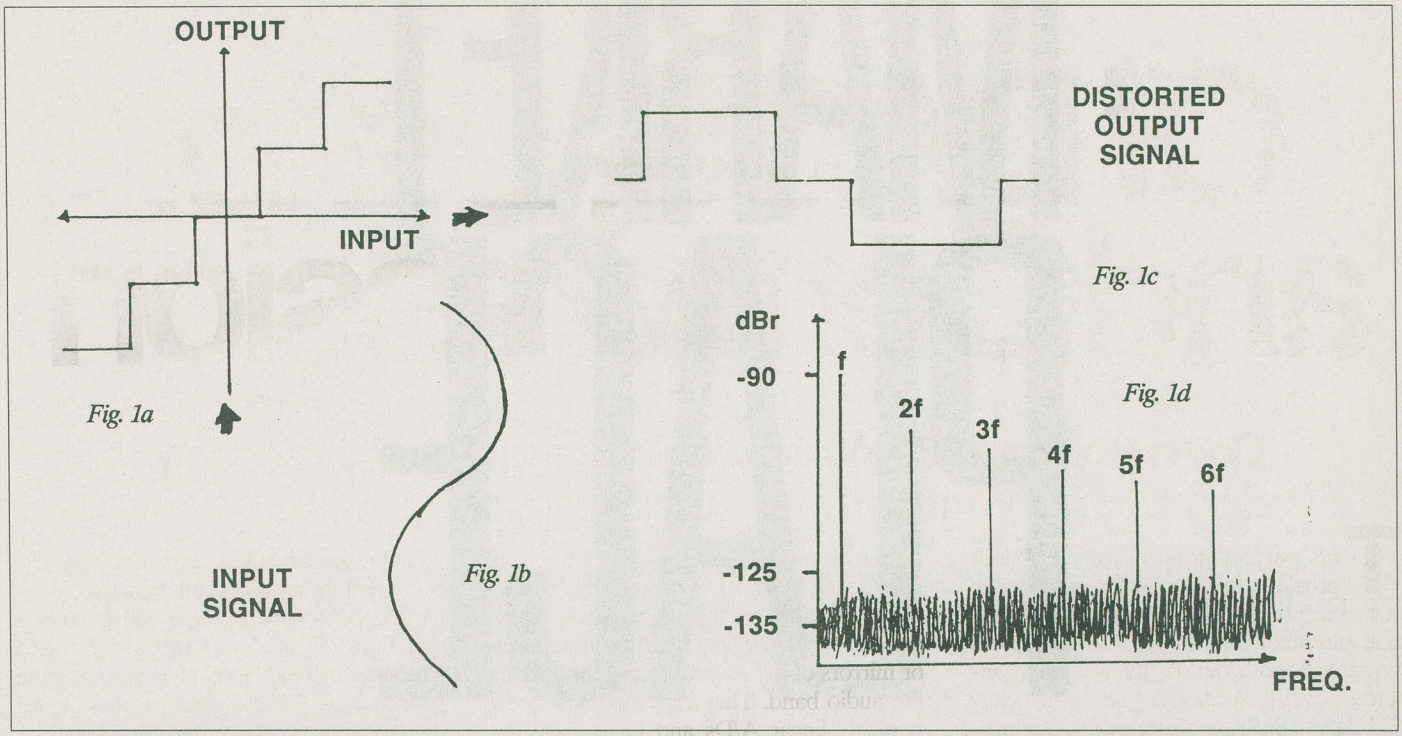
In their paper entitled, "The principles of digital audio, a lecture demonstration," Lipshitz and Vanderkooy brought AES members up to date on their earlier work. This they did by giving a graphic as well as an audible demonstration of the difference between distortion caused by aliasing and distortion caused by quantization error. They showed why digital audio needs its sampling rate of 44.1 kHz, the necessity for analog filtering or digital oversampling and they explained that these methods are used to prevent distortions generated in power amps or to prevent tweeters from self destructing from out of band energy resulting from the sampling process. They showed how poor filtering can cause aliases or mirrors of the original to appear back in the audio band. They explained how even perfectly linear A/Ds and D/As have inherent distortion. Then they went on to show that by adding a small amount of analog noise, during the recording process, distortion can be prevented. They showed how distortion products of quantization become broadband noise when dithered, and how such a digital audio record and play back system is capable of the same quality of sound transparency as a super analog system because all the digital artifacts have been eliminated.

Dwarfed by a table full of equipment in the Royal York hotel ballroom, the two researchers treated their audience to piano music recorded at a very low level and which contained quantization errors due to non-dithering. A buzzing sound appeared attached to each note. Amplified so that everyone could hear it, the effect was obvious and unpleasant. However, when a small amount of analog white noise, or what is called Gaussian dither was added, to a level equivalent to 1/2 an least signification bit (LSB) rms, the buzz in the piano notes disappeared and was replaced by wideband noise. "Undithered signals are pernicious," Lipshitz told his audience after it had endured several undithered piano excerpts from Mussorgsky's "Pictures at an Exhibition" at a somewhat loud level.

The researchers went on to point out in their second paper entitled "Digital dither: Signal processing with resolution far below the least significant bit," that recording studios had better be aware of non-dithered, digital fade outs. "These are equally pernicious," Lipshitz repeated. The two scientists say that even if analog dithering has been used in recording an analog signal, digital dithering must also be used whenever there's a level change during the processing of the signal in the digital domain. "Digital gain reduction (or fading) without dither is highly susceptible to signal distortion, noise modulation and non-uniform signal output gain variation," say the researchers in their paper. For example, there could be changes in level in a piece of music while it is undergoing equalization in the digital domain. Unless digital dithering is added, say Lipshitz and Vanderkooy, the beneficial effect of the original analog dithering will be negated. Distortion will be re-introduced into the signal in any re-quantization process such as conversion from an 18-bit ADC to a 16-bit DAC.

The Canadian researchers were quick to defend reduced S/N ratios saying that the slight amount of wide-band noise introduced into a recording by digital dithering (a noise penalty of approximately 3 dB) is perceived by the ear as being a benign sound. They point out that although wide-band noise has about the same total power as a -90 dB signal, the high Q filtering action of the ear allows it to clearly resolve sine waves well below the noise in much the same way as a spectrum analyzer can.

Vanderkooy spoke extensively about a special form of digital dithering to maintain signal quality while it is still undergoing processing. It's called triangular-probability density function (pdf) dither. The dither toggles over more bits and improves DAC linearity still further, thus resulting in less distortion. It also eliminates the residual noise modulation which simple rectangular pdf dithering leaves behind. Both rectangular and triangular pdf dither are small



The result of a noiseless input signal (Fig. 1c) which is applied to a quantizer (Fig. 1a) such as an ADC. The output of the quantizer is the distorted signal of Fig. 1b. The frequency spectrum is shown in Fig. 1d.

white noise signals whose statistics are specified by the pdf. If you want to hear triangular pdf dither, it's used on cut 20 of the CBS CD-1 test disc that fades from -60 dB to -120 dB over the course of 30 seconds.

Also mentioned by Vanderkooy were "dithered noise-shaping quantizers" that reduce the audible effect of digital dithering by introducing feedback. Noise-shaping is a method of taking the digital round off noise energy in the audio band and moving it to higher frequencies outside the band. Noise shaping by itself in the playback domain is hardly new. It was quietly used in the early Philips players such as the CD100 in order to get 16-bit S/N ratio performance out of a 14-bit DAC. (A Philips representative at the conference says that the giant corporation's marketing division was terrified at the time of the technology because of the reference to "noise." How could CD advertisement copy be written with a phrase like "noise shaping" after consumers had been told of a fantastic system that boasted around 90 dB of S/N!). Lipshitz and Vanderkooy's idea is to take things one step further by re-introducing dither to the noise shaping in order to eliminate all final vestiges of distortion products left over from the noise shaping circuits.

Of course, dithering to prevent distortion assumes perfect operation of ADCs and DACs. These don't exist yet in consumer machines and to make up for converter errors, Lipshitz says one could add more dither, but this would mean unacceptable S/N ratios and there would have to be add and subtract schemes to get rid of the noise. More feasible alternatives presented at the conference included a number of improved converter systems, such as ones using built in noise shaping filters, ones that use psycho-acoustics to fool the ear into thinking that conversion error is not there and of course the one bit data stream now being introduced by Philips.

Carillon Technology of Newton, Massachusetts unveiled an IC chip set for 20-bit A/D conversion. It's claimed that the converter can achieve a S/N ratio of 114 dB and with a 1 kHz dithered signal shows no visible harmonics down to -70dB. Burr Brown also showed the design of its new dual monolithic, 18-bit ADC that produces 1% THD for a 1 kHz signal down at -60 dB. The converter has the familiar pot for adjustment of the MSB. Company spokesman Jimmy R. Naylor admitted that the converter does not have 18-bit accuracy but is called 18-bit for reasons of "specmanship." This prompted sessions chairman David Haynes to observe drily that John Vanderkooy had shown how a 16-bit converter can achieve 18-bit linearity and Naylor had shown how an 18-bit converter can be degraded to one with 16-bit resolution. ■

Artwork by Ross Tucker.

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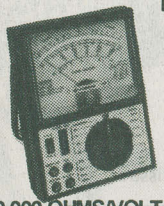

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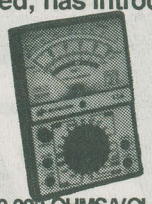

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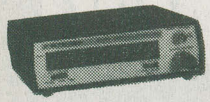

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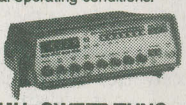

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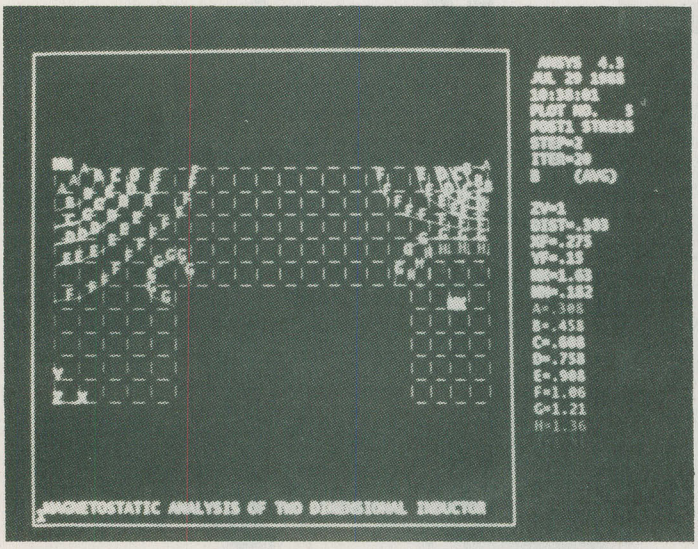

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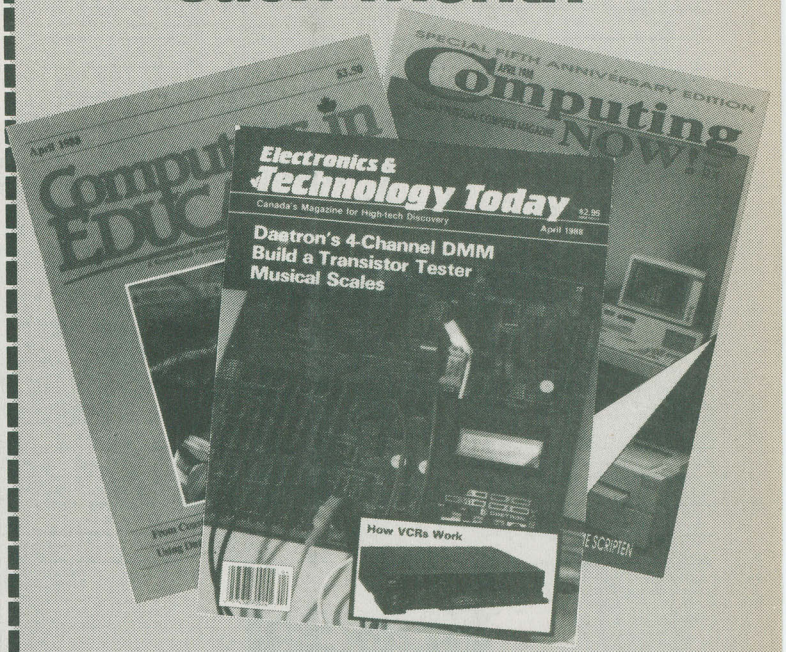

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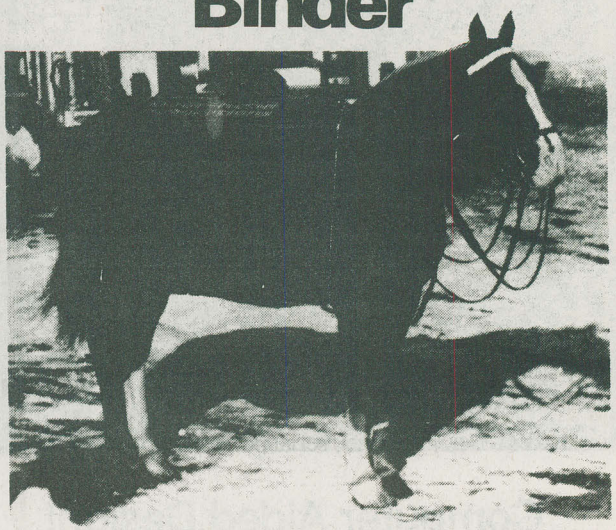

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PC Hardware Interfacing Part 9

This month we'll carry on with the interfacing of the 8250 chip, seeing how to give it interrupt capabilities, among other things.

STEVE RIMMER

In the last installment of this series, we started to examine the circuitry which interfaces the popular 8250 serial port chip to a PC's peripheral bus. As we've seen before, the first step in any interfacing project for the PC is to decode the I/O addresses. With this safely behind us, we can have a look at some of the additional glue that's required to make the chip run.

In looking at a schematic of a completed serial port for the PC... we're still not there this month, although we're getting closer... it may seem that there are just wires everywhere, and that very little of the circuitry makes any obvious sense. One imagines that the whole thing really evolved out of the chip manufacturer's application notes. In fact, this is not the case... the 8250 predates the first PC's, and, unless the notes have changed recently, they don't mention anything about associating the 8250 with an 8086 series processor.

Just as it's possible to design the 8250 interface, as we're doing, wholly from a functional understanding of the chip and the bus it's to be interfaced to, so too can you read the competed schematic in the same way. The easiest way to understand anything with a large scale integration device in it is to understand the device and work your way backwards.

The 8250's support circuitry makes fairly decent sense if you stand in the middle and look outwards.

Address Unknown

As of last month, our 8250 design will know when it is being addressed by the lower potion of the address bus. It does not know when the address is valid, however, nor does it know whether it's intended to read, write or shut up when it sees one of its addresses. To solve these problems, more circuitry is required.

You probably could have guessed that.

The first problem is to make our card distinguish between, for example, this operation:

```
MOVDX,03F8H
OUTDX,AL
```

and this operation:

```
MOVDX,03F8H
MOV[DX],AL
```

In the first case, data will be sent to the port 03F8H, which is, in fact, one of the ports our card is decoding. If this happens, we want our card to sit up and do something about the goings on of the bus. In the second case, data is simply being written to location 03F8H of the current memory segment, which has nothing to do with serial port I/O.

In both cases, however, the address 03F8H will appear on the lower portion of the address bus.

The way the processor differentiates between these two operations at the hardware level is through the use of its control lines. In the first case, it would pull the IOW line. In the second, it would pull the MEMW line. By watching the former line, our card can decide whether it should be doing something with the number on the address bus.

The 8250 is capable of watching the IOW line directly. Obviously, when the processor wants to send data to a peripheral device... pulling IOW... the 8250 should read the data. To this end, it provides two read enable lines, DISTR and DISTR. We'll be using DISTR, and tying DISTR to ground. The two polarities of this function exist in the 8250 because it was designed a a generic serial port chip. Other processors might need a line going the other way, and they could use DISTR rather than DISTR and an inverter.

Likewise, the processor will pull IOR when it expects data to come from the 8250. In this case, we will use the write enable line of the chip, DOSTR. This, too, also comes in a reverse polarity version, DOSTR, which we'll tie low. DOSTR connects directly to the IOR line of the PC's bus.

Interruptus Once Again

We won't get into the programming of the interrupt capabilities of the 8250 for several months, but we have to wire the beast up now. Its powerful capabilities for

generating interrupts as a result of serial conditions is one of the things that makes the 8250 such a useful chunk of silicon.

The biggest problem with asynchronous serial data is that you never really know when it's going to show up. The chip itself can only buffer a single character at a time... not much of a buffer, really... which means that if you don't read the current byte out before the next one arrives, you can kiss it farewell, as it'll get overwritten.

The easiest way around this is to check to see if the input buffer of the 8250 is full at least as often as characters can arrive, allowing for the maximum speed of data transmission at whatever baud rate you're using. This has a number of drawbacks, not the least of which being that at high baud rates most of the processor's time will be taken up "polling" for data.

If you write a simple terminal program using polled communication with the 8250 and the BIOS to write to the screen, a straight XT will lose data at speeds above twelve hundred baud.

The other approach, as we've discussed in previous articles, is to use an interrupt driven strategy. In this case, the 8250 is programmed to pull its INTRPT line every time a character appears at its input buffer. This line causes one of the eight hardware interrupt lines of the PC's peripheral bus to be pulled, which causes the equivalent of a software interrupt to happen within the PC.

Assuming that the owner of the card has had the sense to install a suitable interrupt handler of some sort prior to programming the card to throw interrupts, the processor will leap to a routine to fetch the character from the 8250 and store it somewhere... presumably in a more capacious buffer... for later processing.

This approach means that the processor only has to devote as much time to actually processing the incoming serial data as there is data to warrant it... plus a bit of overhead for the interrupt handler code. It also means that whatever else is happening in the foreground of the computer can go about its life without really knowing that the serial port is busy. We'll look at the actual software architecture of this a bit later on.

The 8250 can generate interrupts for several reasons, and it has an internal register which an interrupt handler routine can look at to determine which purpose a given interrupt is intended to serve. Interrupts can be thrown by the 8250 because of a waiting incoming character, as we've seen, because of one of several error conditions or because the chip is free to send

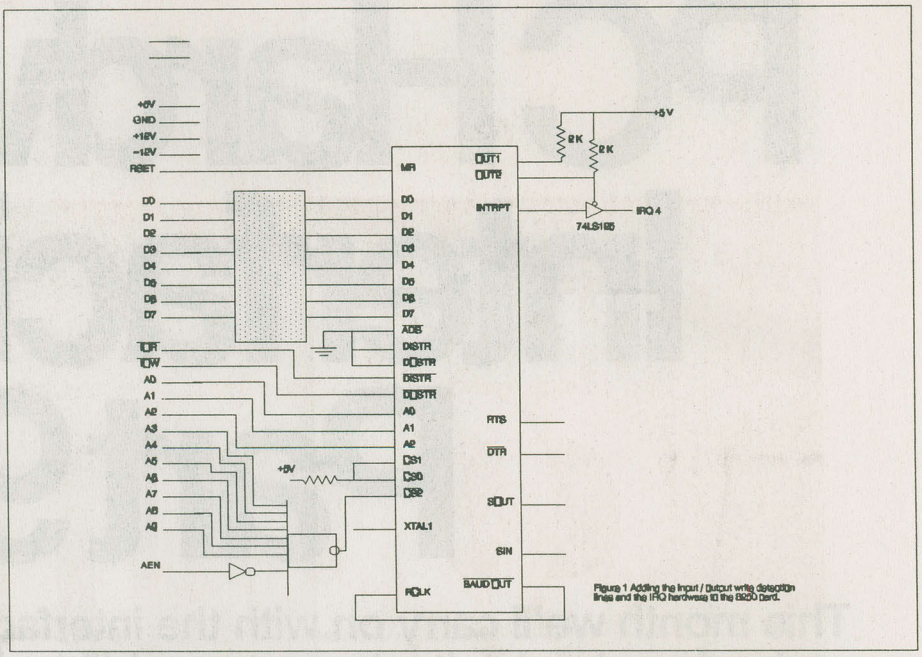


Figure 1. Adding the Input/Output write detection lines and the IRQ hardware to the 8250

a character, that is, because its output buffer is empty. This latter function may seem a bit obtuse. It's actually very useful in writing programs which communicate wholly in the background, as the chip itself can determine the maximum data transfer rate. The only software that's involved is an elaborate interrupt handler.

There are two criteria to consider in interfacing the INTRPT line of the 8250 to the PC's bus. The first is that it would be a good idea if it actually worked, and the second is that it would be a uniquely bad idea if it worked when it wasn't supposed to. This latter problem exists if the 8250 happens to throw an interrupt when it no handler has been installed for one... such as when the machine is powering up, or when the 8250 hasn't been initialized or re-initialized after an application has quit.

It is highly desirable to "gate" the interrupts that the 8250 throws.

One of the other neat features of the 8250 is its provision for having two independent output lines sprouting out of it. These lines simply reflect the status of two bits of an internal register of the chip. I suspect that they were included by the designers of the thing so that software driving the chip could dial phone numbers on old style, non-intelligent modems... with suitable timing code, you could pulse the phone line with a couple of transistors and fool the phone company into thinking your modem was actually a funky old rotary dial phone.

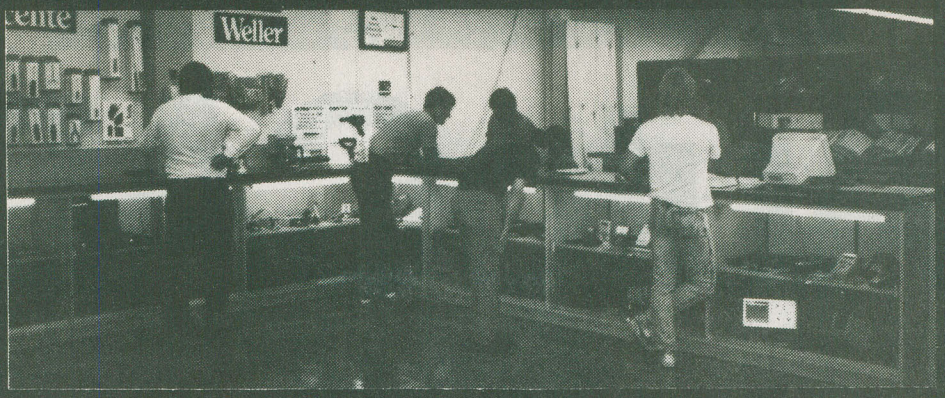
In our case, we're going to use one of these to drive a gate, such that only when the $\overline{\text{OUT2}}$ line is deliberately pulled will interrupts generated by the 8250 be allowed to make it through to the bus.

On a standard serial port card, the other line, OUT1, is tied high and never used. However, it has all sorts of possibilities, and you might want to experiment with it later on. As a really simple exercise, try hanging a transistor and an LED off it and writing a program to make the LED flash. Actually, this can be quite useful, and when we actually write a driver for our card you can set the LED up to flash when data comes in, making the card a bit easier to debug.

There are two hardware interrupt lines on the PC which are dedicated to serial communications. These are IRQ 3 and IRQ 4. The primary port range, starting at 03F8H, corresponds to IRQ 4. When a hardware interrupt finds its way to IRQ 4, the equivalent of an INT 0CH instruction happens inside the PC. The secondary serial port range, starting at 02F8H and using IRQ 3 generates an INT 0BH instruction.

Hard a'Port

We have now worked our card up to the point of its being able to talk to the PC reasonably well. We could program it and have it behave just like a real serial port... with one notable exception. It can't actually talk to the outside world, being as yet unequipped with an interface to a real RS-232C connector. We'll be having a peer at some of that hardware next month. ■



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FEATURE

AutoCAD for Electronics Part5

More tips for rapid drawing and editing, plus tricks for file management.

BILL MARKWICK

Last month, we looked at some uses of the basic AutoCAD commands; this month, more on quick arrays. We'll also check out file management, not a major issue, but one that saves lots of headaches when you're trying to solve problems later on down the road.

Mental Blocks

Last month I was lamenting that AutoCAD wouldn't let you modify any blocks in your drawing unless you rename them. I should have known. It's been pointed out to me that I overlooked the equals sign, AutoCAD's handy symbol for swapping files.

Suppose you've drawn a block and put insertions of it all over your drawing, and then discovered that the thing is drawn wrong. Here's the catch: if it's a simple drawing that doesn't call in any other blocks, you can Explode it, edit it, and redefine it. However, if it calls other blocks (even if it's made up of multiple copies of itself), AutoCAD will say "Block references itself. Invalid".

Here's a way out. Let's say that you've loaded a resistor block Res, and grafted several of them into an attenuator Atten. You want to edit and redefine the block Atten.

First, use the Wblock command to write the original Atten to your disk. Save your drawing and load Atten.Dwg. Edit to your heart's content and save it.

Reload your original drawing and type Insert. When it asks for a filename, type **Atten=C:Atten**. Now the disk version will automatically redefine the drawing's Atten block and replace all occurrences of it. It seems like a lot of jiggery-pokery just to change a block, but it beats re-editing each occurrence.

Array of Hope

Previously, I mentioned that the Array command was wonderful for inserting rows or circles of objects, but that it was limited to straight lines, and that it was also difficult to space the objects just right. Here are two other types of arrays that pretty much fill the bill for multiple insertions.

Divide is a command that can mark a line into any number of equal parts if you give it a number, or it can insert a block instead of markers if you type a B and then a block name. By the by, the first time you try to divide a line into segments you may get no results. This is because the command uses the Point function, which is normally set to zero. Use **Setvar Pdmode 2** for a cross, 3 for a rotated cross, etc. **Measure** works in exactly the same way, except that it marks off a line in some requested measurement rather than a number of equal segments. For instance, if you Measured a 25mm line into 8mm segments, you'd have 1mm left over at the end. If you Divided the same line into 8 segments, it would come out evenly, with each segment being 3.125mm long.

Suppose you wanted 10 LEDs and associated resistors to fit neatly along the bottom of an existing schematic. First, draw a ground line (or supply rail) the desired length under the existing part of the drawing. Next, draw or insert an LED and a resistor. Mark the two as a block.

Now use the Measure command to insert ten blocks along the line — but to do this, you'll need to ask for *eleven* segments. Note that there's a bit of overhang at the beginning and end; this can be removed with the Trim command.

If you know the length of the line and it's an easily divided number, the Divide command will work as well. Note that Divide and Measure work equally well with Lines, Arcs, Circles and Polylines.

Files and Directories

When you first started AutoCAD, you may have just loaded it onto your hard disk using a directory called \ACAD or similar. This works for a while, but when you consider that AutoCAD consists of more than 64 files (without sample drawings or drivers), it won't take long for your directory to become unmanageable. Soon one DWG filename will look like another (unless you care to number your files and keep an index).

One cure for this block madness is to store all your blocks in subdirectories; if you do nothing but electronic drawings, you can probably get by with one or two subdirectories for schematic symbols and so on. If you do complex architectural drawings, you might want a whole series of subdirectories.

However, when you go to Insert your drawing, you'll find that you'll have to type your brains out: "Block name: C:\ACAD\PLUMBING\FIXTURES\Toilet" might be a typical filename. To get around this, you can write your favorite block names into a pulldown icon menu as described in the second part of this series. Another way is to borrow a programmer's DOS trick and create some fake disk drives. Here's how it works. MS-DOS lets you define the number of disk drives from A to Z by inserting the line LASTDRIVE=n into your Config.Sys file, whether the actual mechanical drives actually exist or not (check your manual to see whether or not you have this feature if you're using DOS versions prior to 3.0).

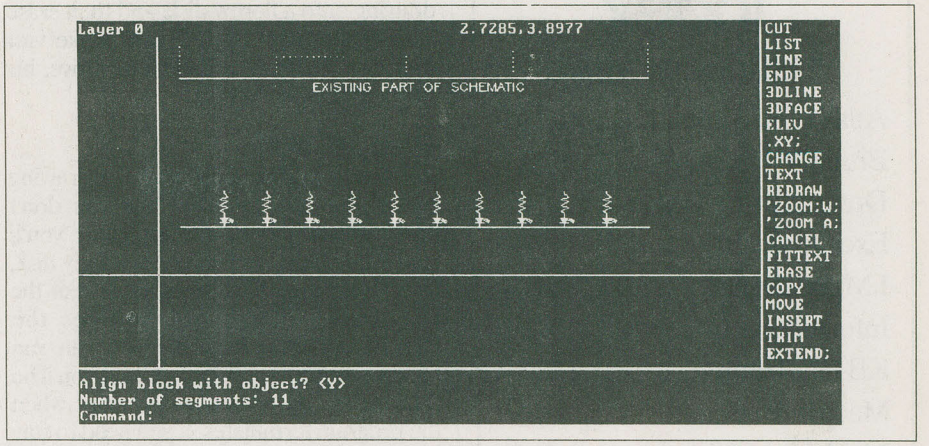

Fig. 1. The Divide command is used instead of Array to quickly insert a line of blocks into a drawing. Some trimming of the line is needed.

Next, your DOS utilities disk should have a file called SUBST.EXE on it. Put this line in your Autoexec file: SUBST n: C:\ACAD*dimame*, where "n" is the letter of a drive that doesn't actually exist and *dimame* is the name of your drawing or symbol subdirectory.

Now when AutoCAD asks for a block name, you just have to type *n:blockname*. The SUBST command will make DOS think that your subdirectory is actually a disk drive.

Needless to say, the same technique can be used for Drawing files, although you may prefer my method for these: create and edit the file on the hard drive for best performance, copy the finished

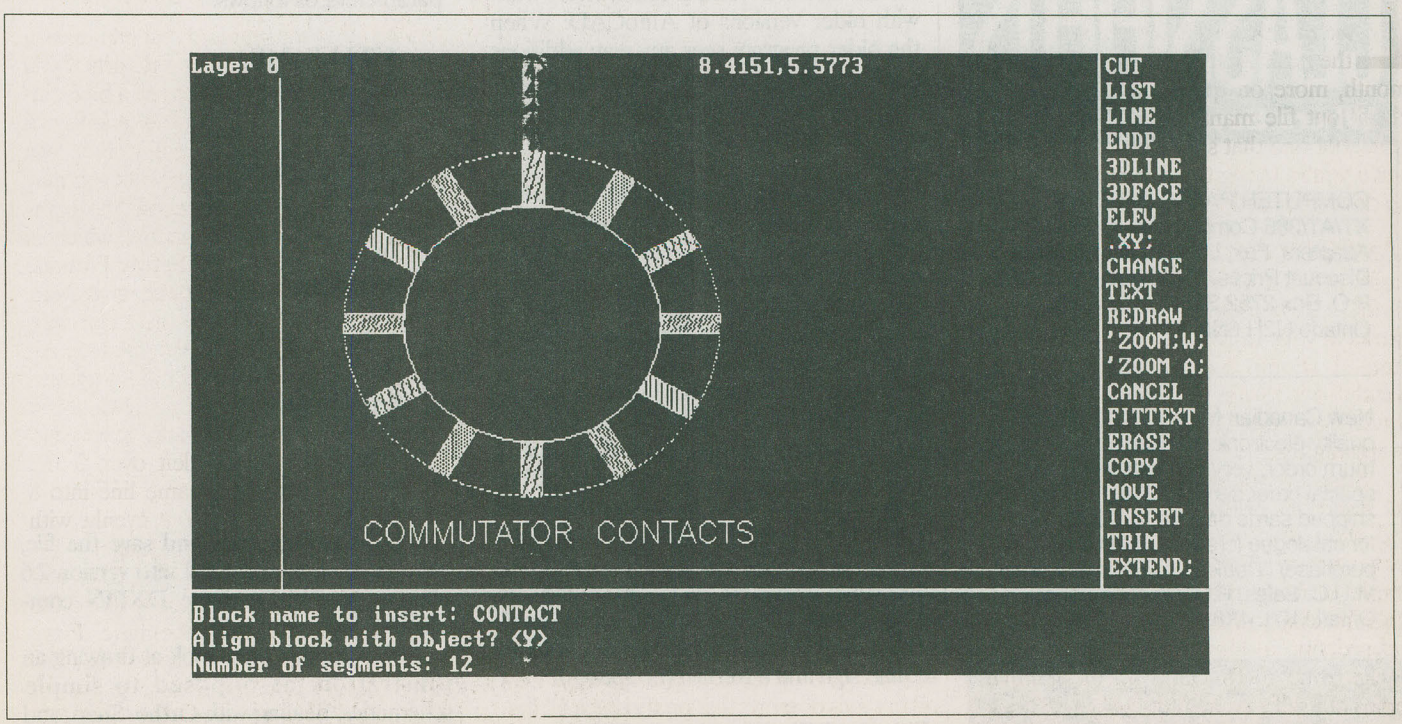

Fig. 2. The above Divide command can also be used for circles, arcs, etc.

AutoCAD for Electronics, Part 5

drawing onto a floppy disk, and then erase it from the hard drive. If you make vast drawings and have a huge hard drive, his obviously doesn't apply.

Files and DOS

It's inevitable that you'll load the drawing editor and suddenly find that you don't know where your block file is, or you'll remember that you left it on a floppy disk, or something similar. No need to exit the program – AutoCAD provides the SHELL function for this. You can run DOS commands or full programs; you'll be returned to the Command prompt when the program terminates. If you need to stay in DOS, type a Return when the words "DOS Command:" appear. When you're done, type Exit to return to the command prompt (the DOS prompt will appear doubled to let you know you're in the shell, like this: C:>).

If you get not-enough-memory errors, check your Acad.Pgp file by calling it into an ASCII word processor, such as WordStar in the non-document mode. Autodesk's default value for Shell is 127K; I found that increasing it to 256K runs any program I need. You'll also notice the command SH with a default value of 27K; this can be used for smaller programs or internal DOS commands.

Files In and Out

One of the problems in sending a DWG file out into the world is that it won't work with older versions of AutoCAD. When the older program sees any new additions it will dig in its heels and refuse to budge. Why Autodesk didn't see fit to let the older versions ignore new additions, I don't know.

The universally popular DXF file format suffers from the same problem; an older version of AutoCAD will turn up its nose if it sees new features in the DXF. Incidentally, loading the DXF format is badly explained in the Reference Manual, and you may have had a few "file discarded" messages while vainly attempting to import a DXF file. The trick is this: for unknown reasons, Autodesk insists that you load DXF only into a new file, but if you select a new file from the main menu, it won't work. It turns out that since AutoCAD configures each new drawing according to the ACAD.DWG template, it's not truly a new drawing... Odd, non? The cure is to follow your filename with an equals sign and a Return (no spaces):

Enter NAME of Drawing: BLEEN=

This loads a new drawing without reference to the template file; the very first command should be DXFIN. This should work every time if you don't have compatibility problems between versions.

One away around the software problem is the IGES file (International Graphics Exchange Standard). This is a very peculiar format which swells your file to five times its size or more (it converts the DWG format to ASCII) and at the same time, leaves out certain functions. I've had it ignore hatching, fills, and solids. On the other hand, it does mean making file transfers without worrying about device dependence.

Like the DXF, IGES drawings must be loaded into a new drawing using the *filename*= trick. If you make fairly large drawings, the bloated IGES format may overload any floppy disk that you use for transport. The drawing STPAULS, for instance, which is about 44K bytes, gains weight to 325K in the IGES mode.

Downward DXF

If you need to draw something in Release 9 and send a drawing file to someone with version 2.6, here's a fix that's cumbersome, but it works. First, use the Style command to set the text style to Standard. Then make a DXF file of your drawing. Load the DXF file into an ASCII text editor (WordStar in the N mode or the equivalent) and find lines 382 to 397. You should see four parameters, as follows:

```
$SPLFRAME
 70
   0
 9
$SPLINESEGS
 70
   8
 9
$ATTDIA
 70
   0
 9
$ATTREQ
 70
   1
 9
```

Delete these lines and save the file, which can now be loaded into version 2.6 using a new file and the DXFIN command.

Next month, we'll look at drawing an illustration, as opposed to simple schematics: dealing with Ortho, Snap, and Dimensions. ■

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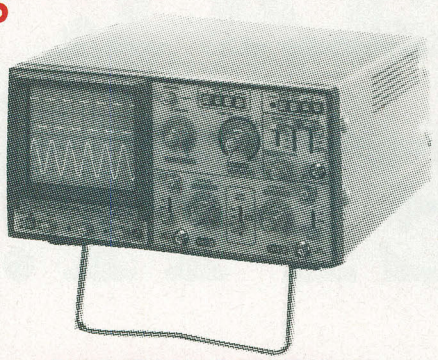
1	2	3	4	(5)	6	7	8	9	10	11	12	13	14	15	(16)	17	18	19	20
21	(22)	23	24	(25)	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	(49)	50	51	52	53	(54)	55	56	57	58	59	60
61	62	63	64	(65)	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100

GW THE QUALITY LINE

DUAL TRACE OSCILLOSCOPES — GOS SERIES



For performance and reliability.

- Select from five models.
- Dual or single trace.
- Band width: 40, 20 MHz.
- Triggered/Delayed sweep operation.
- Sensitivity to 1 mV.

COUNTERS — GFC/GUC SERIES

Full featured, dependable and value priced.

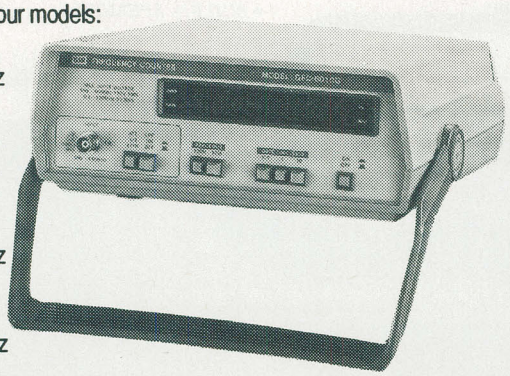
- Choose from four models:

Universal
5 Hz-100 MHz
GUC2010

Intelligent
DC-1.3 GHz
GFC8130

Frequency
1 Hz-550 MHz
GFC8055

Frequency
1 Hz-120 MHz
GFC8010



- Easy to read LED display.

DIGITAL MULTIMETERS — GDM SERIES

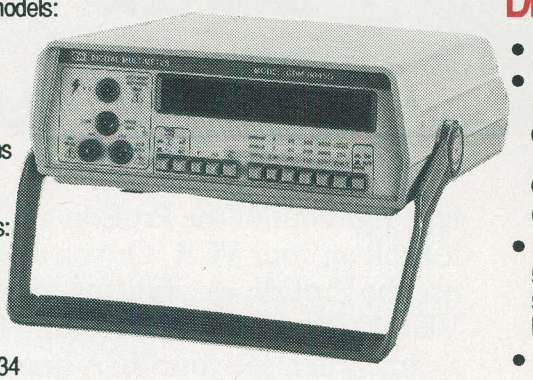
Rugged and reliable—for the lab, field or production line.

- Select from four models:

3 1/2 or 4 1/2 Digit Display. LED or LCD Digital Display

- Standard Functions (AC/DC Volts/Amps & Resistance) plus:

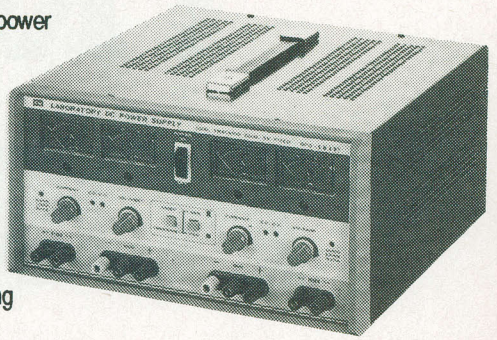
Diode check
Continuity Test
Capacitance
1.99 nF to 19.99 uF GDM8034



- Accuracy: to 0.03% (TRMS) GDM8045; to 0.1% DCV GDM8035.

DC POWER SUPPLIES — GP SERIES

Over twenty quality power supplies for the lab, classroom or production line.



- Single, Dual or Quad output
- Dual-tracking Volts/Amps. (GPD/GPQ) 0-60V./0-10A
- Analogue metering or Digital display
- Regulation 0.01% typical

WAVEFORM GENERATORS GFG/GPG SERIES

An exceptional combination of Functions and Features.

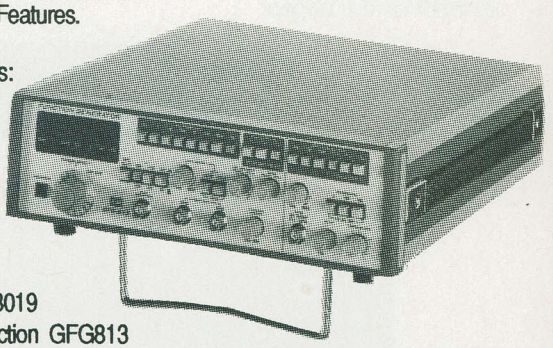
- Select from these models:

2 MHz Function
GFG8015/ 8016/8020-

2 MHz Sweep/ Function
GFG8017/8019

13 MHz Function GFG813

5 MHz Pulse GPG8018



- Waveform Output: Sine, Square, Triangle, TTL Pulse & Ramp

DIGITAL IC TESTERS – GTC/GUT SERIES

- Test up to 1800 popular ICs.
- Choose between two models:

GUT6000
(1800 types)
GTC3000
(1700 types)

- Test:

54/74 Series TTL
55/75 Series TTL
High Speed CMOS

- Repetitive Test Cycle for Production Usage.
- Auto-Search identifies unknown ICs.

CSA Approved where applicable — One Year Warranty. Available through your local electronic distributor.

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ELECTRONIC INSTRUMENT SPECIALISTS

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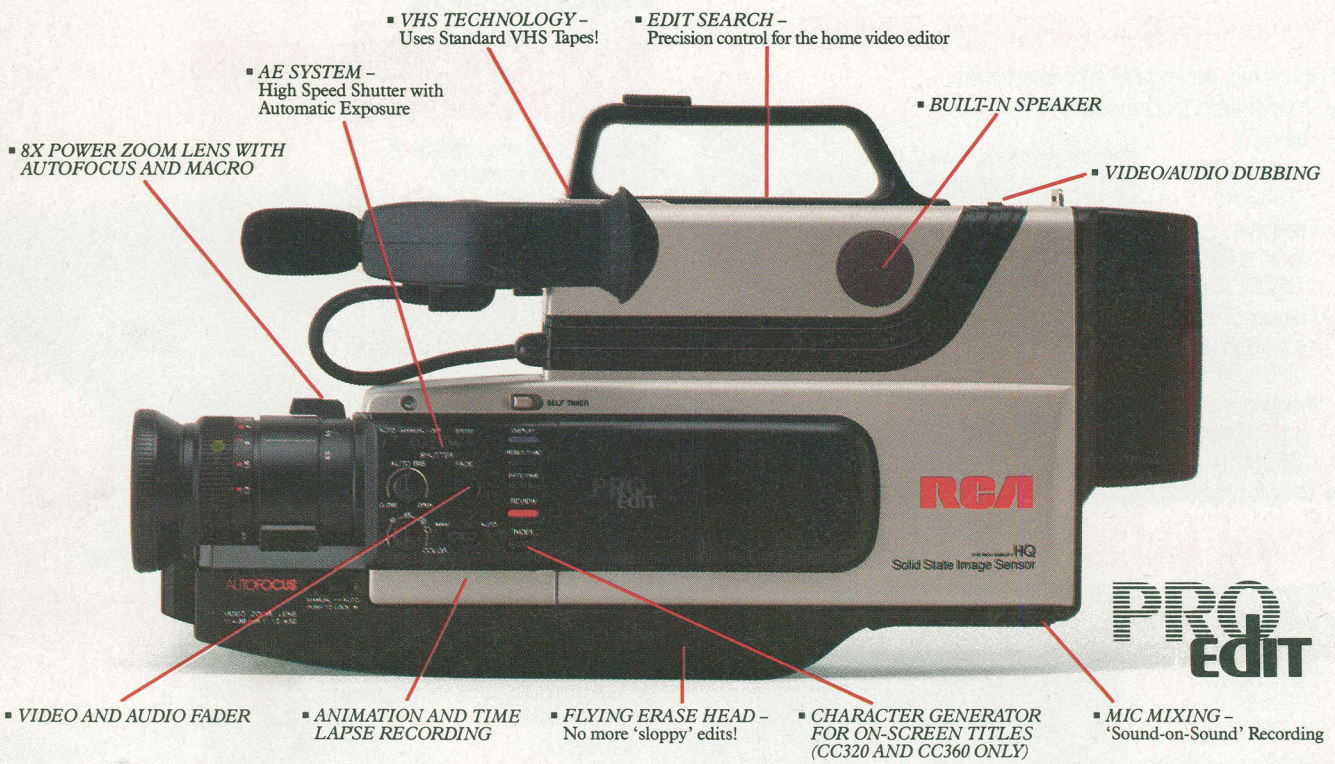
TELEPHONE: (416) 742-4448 FAX: (416) 749-5053

Circle No. 20 on Reader Service Card

IF IT'S NOT A PRO-EDIT, FORGET IT.



When it comes to camcorders, the only name to remember is RCA ProEdit. Our exclusive ProEdit system makes high technology simple, so you can make professional-looking videos at home. And with the convenience of VHS technology, you can take the tape right out of the ProEdit and play it back on your VCR. Or you can use the ProEdit as a full-functioning VHS VCR. So if you're looking for a camcorder, see your RCA brand dealer, because if it's not a ProEdit, forget it!

RCA

Thomson Consumer Electronics Canada, Inc.

Circle No. 21 on Reader Service Card